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KOLGUEFF ISLAND.*

By AUBYN TREVOR-BATTYE, F.L.S.

By far the most exhaustive account of Kolgueff at present written is given by Professor Saweljew, to whose own work I shall presently refer. From his paper (Erman's *Archives*, 1852, vol. x. p. 302, etc.) I take much of what immediately follows.

The first description of Kolgueff is in the fourth volume of Lepechin's 'Journey.' But Lepechin was never there. He took his account from an anonymous article in the *New Monthly Paper*, a Russian magazine of that time. The Russian maps of Kolgueff were then drawn either after the Dutch, or more probably after maps prepared by the Pomors of the coast. In 1823–24, Lütke, on his third and fourth voyages to Novaya Zemlya, crossed over to the shore of Kolgueff, determined the latitude and longitude of the north-western and the longitude of the western point, and took views of some points of the north-west coast. (I may here remark that the coast of Kolgueff is always changing, and I failed in every attempt to identify points from Lütke's projections.) Then in 1826 a separate expedition, under the command of the under-pilot Berejnyeh, was equipped for the survey of the coasts of the ocean to the mouth of the Pechora to the east; of the Tsekh Gulf; of the eastern shore of the Kanin peninsula; and of the island of Kolgueff. This expedition executed its commission during the two summer months, visiting all the points named, except the Tsekh Gulf. The surveys of Kolgueff were well accomplished, with Karbasses, in four days. Between July 21 and 25 the expedition circumnavigated the whole island; still up to the year 1841 the island

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had not been visited by a single naturalist. In that year Professor Saweljew and Dr. Ruprecht visited the island. They landed at the Waskina, and Dr. Ruprecht made an excursion thence with reindeer. They then tried to sail round the island. They landed at the Gosina and at the Konkina, but were then compelled by bad weather to desist, running for Sviatoi Nos. In August they again visited Kolgueff; this time they went to Sharok harbour, and again Dr. Ruprecht made an excursion; and now I will quote Saweljew's own words: "It must, however, be mentioned that our stay on Kolgueff was made under the most unfavourable conditions. Of the sixteen days which we passed at the mouth of the Waskina and in Stanavoi Sharok, the weather on ten was such that it was impossible to think of investigation and excursions on the island; the violent storms did not allow us once to leave the cabin. In spite of this drawback, Ruprecht succeeded in *completely describing* the flora of the island, while I was able to determine the latitude of the mouth of the Waskina, as well as to take observations on the inclination of the magnetic needle. Since this time, so far as I am aware, Kolgueff has been the goal of no other voyage of scientific inquiry."

I may add to this, that, so far as I am aware, since this date (1841) no naturalist had visited Kolgueff until we went this year. I have not yet had an opportunity of comparing my plants (a list of which has been most kindly prepared for me by Dr. Carruthers) with Dr. Ruprecht's, but in one deduction at least he was out. So much lower is the temperature of Kolgueff, he says, than that of the mainland, that "*even the cloudberry does not ripen there.*" Now, I suspect I owe much of the good health I had on Kolgueff to the eating of ripe cloudberries, which we gathered by the bushel.

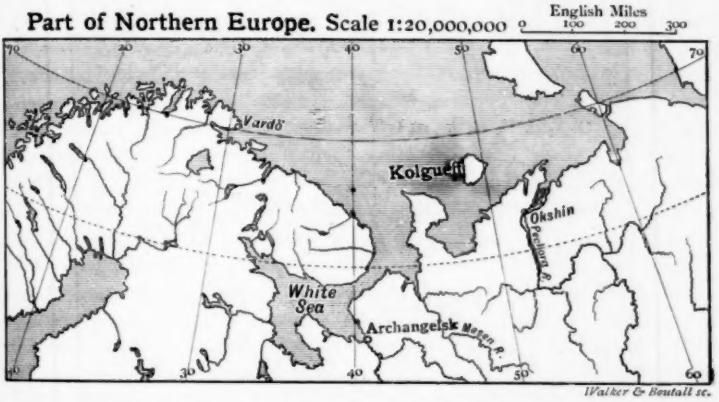
With the exception of scattered references—as, for instance, in the French 'Geographical Dictionary'—I can find nothing written about Kolgueff excepting the following (they are both in the Russian). The first, which appeared in 1832 in an important publication (*The Russian Review*, p. 284), is remarkable as the work of one who was profoundly indebted to his imagination for his facts: the whole account is a tissue of inaccuracies. The second is really a very quaintly curious paper; it is to be found in Maximow's 'Morskoi Sbornik.' It is the account by a priest (he does not divulge his name) who visited the island in 1852 for the purpose of baptizing the natives. He does not tell us from where he sailed—perhaps from Mezen, as he had, he says, 150 versts of sea to cross. He says that before he started he sang *Te Deums* during three days. Nevertheless, he was very sea-sick; though it is evident that he struggled manfully with this enemy, for, as he remarks with truth, "One cannot gain much lying on one's back." He gives further on a delightfully quaint description of goose-catching, which, in all essentials, agrees with our own experience. I may

mention that on one occasion we caught at one haul of the net 3300 Brent geese.

With this we will leave the literature of Kolgueff, and turn to the island as we found it.

Kolgueff is, according to our chart, an island lying between 68° 43′ and 69° 30′ N. lat., and reaching from 48° 15′ to 49° 55′ east of Greenwich. Its southern point is 46 miles from Sviatoi Nos, which lies due south of it on the Timenskii coast, about 110 miles from Cape Kanin to the west, and 70 miles or so from the westerly point of the Pechora entry to the east.

Kolgueff lies in an exceedingly shallow sea, the soundings showing, on the west, south, and east sides, only about from 4 to 5 fathoms of water at 2 miles' distance from the coast. This condition accounts for the ill reputation which the island has always borne with navigators in those waters. To the south and east lie big sandbanks, which forbid

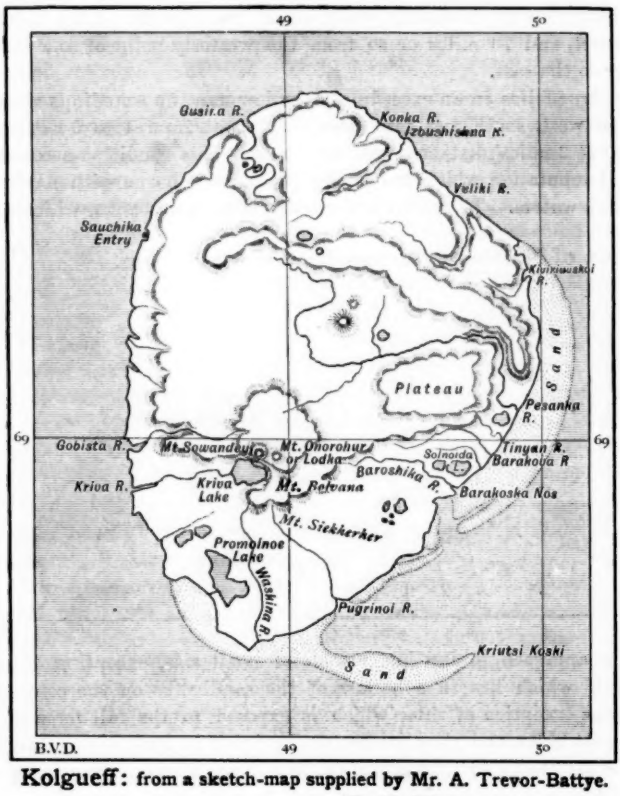


a close approach to any but vessels of small size, excepting through the gulf which lies in a hollow of the sandbanks on the south-east. With the exception of this (which is exposed to the full force of the north-east gales, and they greatly predominate in that place), Kolgueff may be said to be without a harbour of any use to the chance navigator. For Sharok "harbour" on the east is not only approached by a channel of intricate character, demanding intimate local acquaintance, but is closed in by a bar, above which, in ordinary high tides, there is no more than from 7 to 8 feet of water.

Of the rivers, the Waskina, Kriva, Gobista, Gosina are closed by a bar; the Pesanka debouches behind the sandbanks; and the Pugrinoy, though it has an open mouth, has in its estuary at high tide a bare 6 feet of water. Anchorage outside the island is everywhere either solid sand or (occasionally) clay, and is good and holding in character.

The cliffs highest to the north-west rise there no higher than 60 feet. No rock is visible in these cliffs. Everywhere they are either of yellow sand, grey sand containing small stones, or of green or bluish clay, according to the local section.

The superficial area of the island is sharply divisible into two portions. Speaking generally, the northern two-thirds are high ground,



Kolgueff: from a sketch-map supplied by Mr. A. Trevor-Battye.

Scale 1:1,000,000 English Miles 10 5 0 10 20

which consists of peat-covered or of bare ridges intersected by gullies and enclosing small lakes and swamps, and the remaining portion to the south is a dead flat of grass, bog, and peat-levels reaching down to the sea.

Besides lakes innumerable of smaller size, there are two specially deserving of notice. The first, Promoinoe, or mountain lake, which is

shown on the oldest plans I have seen of Kolgueff, and, according to my observations, is correctly entered on our chart, excepting that its eastern arm extends some half a mile further than is there indicated. The overflow from this lake passes on to the flats of the coast, and there forms a shallow basin which fills and empties at every tide, and would therefore now be incorrectly described in my view as shore *lake*. It seems not improbable, however, that when Saweljew saw it fifty years ago there was greater continuity of shore-line than there is at present. The second largest lake is interesting as being the source of the Kriva river, which leaves it at its south-western extremity. This lake, which is roughly rectangular in shape, is, according to the statements of the Samoyeds who fish in it, 21 feet deep at its deepest. Its southern shore-line is sandy, running by small inlets up into the grass of a flat plain among the hills; the northern shore is entirely composed of stone and boulders, apparently washed out of the higher ground, which there approaches it. There are no reed-beds in this lake; it is clear and clean in character. It abounds in "sik," a well-known species of bream (?), whose specific name I do not know. This fish has a very remarkable modification of the upper lip, doubtless to aid it in grubbing among stones. One of these fish, weighing about 2 lbs., which I took away from a glaucous gull which had just killed it, had its gullet full of small stones. According to the Samoyeds, the "goletz," a species of *salmo* (or of its ally *coregonus*), runs up into this lake from the sea. And as the small boat of our yacht was able to cross the Kriva bar at high water, there is no reason why it should not do so. This lake is always spoken of by the Samoyeds simply as "Toh," *i.e.* the lake; I heard no other name for it, though I always defined it as *Kriva* Lake. I have failed to find this lake in any map of Kolgueff.

I do not know how a large lake came to be entered on the chart close to Sharok harbour. There is no lake there. But there is a fair-sized lake, as this map shows, further inland, and again north of the Baroshika river (called by the Samoyeds Nioitsko Barko) lies a very beautiful and interesting lake with immense beds of reeds, which the Russians call Solnoida, but the Samoyeds Solnoi Toh. I have not only the Russian names (where these exist), but also the Samoyed names for almost all the physical features of Kolgueff, and in my thinking the map which gave them would be by that addition the more interesting. Everything points to a very ancient occupation of Kolgueff by Samoyeds. It is therefore possible that the meaning of their names, if it could be traced, might point to facts and customs which have now died out. I am only too sorry that my knowledge of the Samoyed language, though sufficient for everyday wants, does not allow me to follow out so promising a line of inquiry.

I have mentioned the Pugrinoy as a river which debouches on the gulf, and into which small boats or a small launch could enter. It is

very strange that no mention should be made of the river on any map or chart that is available. But if instances were wanted to show how inadequate has been any previous examination of the island, the following facts would supply those instances: First, the Sauchika river, one of the western rivers so named on our chart, is not a river. At this point of the coast there is a double entry to a small tidal lagoon, which lies out of sight behind the cliff. Into it trickles only a little brook which you can step across. Secondly, the largest river of all has been missed altogether. This river is the Pesanka. I do not for one moment pretend that I have *accurately* mapped this river, or even that I have followed it from start to finish. But I have crossed it near its source, and at more than one point lower down, and also its two tributaries; while its mouth, and the river itself for some 10 miles from its mouth, was the scene of much of our shooting and bird-collecting. Its actual small windings are doubtless very different from anything which appears here. But I believe that later investigation will go to show that the *general* course is, *on the whole*, correct; while that part of it nearest the sea I determined, as carefully as I was able, by estimation of distance and cross-bearings with the prismatic compass from various points, *e.g.* Barakoska Noi, the Pesanka Gora, and the plateau where we had one camp.

Of mountains there are on Kolgueff none that fairly deserve that name. Sowandeyi and Siekherher, the two highest points on Kolgueff (named by the Samoyeds from hills of the same name on the Timenskii Tundra), are, as near as I could estimate them by aneroid, 100 feet high, and at their bases 150 feet above the level of the sea. They are, essentially, great heaps of sand, terminating in peaks and ridges, piled up in a curious confusion of crater-like hollows and gullies worn by melting snow. They were, I believe, the last places where the winter snow remained on Kolgueff; and it had not all melted there when I visited them on August 26. Bolvana Gora, though scarcely so high, is really a remarkable hill in appearance. Thickly covered with grasses, almost completely circular at its base, it rises suddenly from the general level —a conical hill as smoothly and regularly formed as though an old artificial camp. The other mountain, Honorohur of the Samoyeds, is a very conspicuous object from far around, and very characteristic in shape; so that it is called by the Russians Lodka (the boat), for that is the appearance it presents to them when seen from the mouth of the Pugrinoy, where their boats sometimes go.

It will have been gathered, from what I have said, that Kolgueff is essentially a water and ice formed island. In this it differs from any other important island of those seas, Novaya Zemlya being really a disconnected spur of the Urals, and Spitzbergen, as we are told, a survival from a great continent of the Secondary Period. What is Kolgueff's exact relation to the adjacent Tundra, I do not yet feel able confidently to pronounce. Doubtless, like the Tundra, it rests on a granite

basis. But of continuous rock there is none which appears in any section. All is either in the nature of alluvial deposit, or of sandstone more or less imperfect, or of isolated blocks of glacier-borne granite. I am inclined at present to regard it as a recent island, elevated from beneath the waves; and I think it probable that my specimens, when more critically examined, will prove this view correct.

The traditions of the Samoyeds themselves and of the Russian traders of the Pechora seem to point to a very old occupation of Kolgueff by these people. There was never a time, so far as I could learn, when the island was not occupied by a *resident* population of Samoyeds. Prior to the year 1860 there were many Samoyeds there, and many reindeer, one merchant alone owning 10,000 of these animals. For in those days there was traffic not only with the Pechora, but between Mezen and Indiga—the nearest towns of the coast—and Kolgueff. Then there came a great reindeer plague, the Mezen and Indiga traders lost their reindeer, and with that all their connection with Kolgueff ceased, and so absolutely that in the short space of thirty years all knowledge of the island has passed out of the minds of these people. That was why, when the Foreign Office most kindly took up the question of our position, nothing whatever could be learnt about it. Only one family—the Samarokoff of Okshen, on the Pechora—retained their old connection with the island, and with them alone remained, so to say, the secret of Kolgueff. These were the men who brought us off.

About the middle of last century (1767), 60 or 70 Raskolniks, men and women, chose this island as their asylum, and settled, it is said, at the mouth of the Gusina, where Saweljew declares he saw traces of their huts. Some accounts say they all died that first winter of scurvy; others, that one or two only survived and abandoned Kolgueff the following year. At the present time there are, all told, 59 Samoyeds here, and they represent nine chooms. The oldest of them is old Yelisei, who says he is seventy, and has been on Kolgueff fifty years.

Of buildings, there is a collection of huts (Isba and Ombara) at Sharok, and also on the Pugrinoy, where also is a very nice little church built many years ago by Alexis, the Russian who owned the 10,000 reindeer, as a set-off to Sibiriakoff's church at Khabarova, on the Yugorski Shar. But of course there is no priest to serve this church. There is also an isolated Ombara on the Gobista owned by Mark Ardeoff, an old Samoyed, and a second in the Pesanka mountains, owned by Uano, who first befriended us.

Before the reading of the paper, the PRESIDENT said: Mr. Trevor-Battye, who is now on my left hand, gave us some anxiety during the autumn; he assures me there was not the slightest cause or reason for it, but our ignorance must be our excuse. Sir Hugh Willoughby told our ancestors that that low land he sighted in the position of Kolgueff was apparently uninhabitable; moreover, it was within the Arctic Circle, and winter was approaching. However, we have got Mr. Trevor-

Battye safe here now, and I hope you will give him a very hearty welcome, for he is about to enlighten our ignorance, and to tell us of a part of Europe previously almost entirely unexplored—a region limited in extent, it is true, as we must expect unexplored regions in Europe to be; but, at all events, the account of it will be new to us, and I feel quite sure he will make it a very interesting one.

After the reading of the paper, the following discussion took place:—

Mr. Seebohm: I am sure we have all listened with very great interest to the very graphic account which has been given to us this evening of a place where an Englishman has probably never set foot before. Nearly twenty years ago, in the year 1875, when Mr. Harvie-Brown and I visited the Pechora, on the mainland a little to the east of Kolgueff, we found that, as far as we could ascertain, no Englishman had visited that valley for at least 250 years; so that, although it is in Europe, you must admit that this part of the world is one which has been very little explored by Englishmen. Mr. Trevor-Battye has given us a passing notice of the geese upon the island, but he said very little of the various kinds of birds which breed there. He was very anxious, of course, to find the eggs of the Curlew sandpiper. This little bird is probably better acquainted with the geography of the Arctic regions than any Fellow of the Geographical Society. It is not at all uncommon upon our English coast in winter; it goes down into the Mediterranean; it is found in Central Africa, in various parts of Southern Asia, and even as far as Australia, yet we do not know where it breeds. Harvie-Brown shot one or two at Archangel; I shot one in the valley of the Pechora, and another in the valley of the Yenesei; Middendorff saw a few up to the middle of June in the Taimyr peninsula. Further east Dr. Bunge, a celebrated Russian explorer, found them migrating northwards in very considerable numbers in the delta of the Lena valley, and they disappeared also about the third week in June. He was afterwards on the Liakoff Islands further to the north, and there he observed them until about June 20, when they disappeared. The only inference to be drawn from these facts is that there must exist some places further north than these I have mentioned, which in summer are sufficiently adapted for this little bird to build its nest and to rear its young. This is a very important geographical fact, which we only know from the migration of this little bird. There is one thing Mr. Trevor-Battye has not mentioned to us, and therefore I think we may fairly conclude that he did not observe it—that is, on the island of Kolgueff there is one enormous advantage which the mainland does not possess: the cold winds are sufficient to drive away the mosquitos. I do not know whether he met with mosquitos [Mr. Battye: Yes], but it is the one fact on the mainland that impresses itself upon the traveller most strongly. The migration of or variation in the ice is also an extremely interesting point. Harvie-Brown and I left the mouth of the Pechora about August 4, and sailed in a small brigantine, about 120 tons, north of the island of Kolgueff, and did not see the slightest sign of any ice; but this very ship, in trying to force its way into the lagoon of the Pechora through the barrier islands that protect its coast, had to wait several days before it could find a passage through the ice. This points to about the ordinary date when the ice clears away, which, as you will see, is extremely late in the year, and may be variable in different seasons according to the prevailing winds. There is another point to which attention has not been drawn for want of time, and that is, the country, during the period when the ice is breaking up in the spring or when it is beginning to form in the autumn, makes travelling almost impossible. We made the journey from Archangel, went by land and came back by sea, and therefore had the disadvantage of having before us the continual worsening of the road by the melting snow, and in various places we really thought we should have been finally stopped in our progress. Our horses were up to their

bellies in the snow, and we had to unharness them, let them plunge out as best they could on to hard ground, and push the sleigh after them. I may say the account given of the Samoyeds—or, if you like, the Russian plural Samoyedi—is extremely interesting. I have seen a very great deal of them, both at Archangel, Mezen, the valley of the Pechora, and the valley of the Yenesei. If you put the time together, I have spent something like six months amongst them, and have been extremely interested in hearing the graphic account of them. One thing Mr. Battye promised to tell us, which he forgot to do, and that is the extraordinary catch of geese which they had, and which, I am sure, must have been an exciting scene. I have seen something of these geese when they are moulting so rapidly, as they are obliged to do in the extremely short season, that they are absolutely unable to fly, and I think, if I am not incorrect in remembering what Mr. Battye said, the Samoyeds, when they had surrounded them, caught something like 3300, which is an enormous catch. I have an extremely vivid recollection of finding these geese precisely in the same condition, and the reason why I remember it so well is because Mr. Harvie-Brown and I, together with some Samoyeds, possessing in all but a dozen cartridges, had to wait for a ship which was to have come to fetch us, but owing to the stormy weather was unable to do so, and if we had not fallen in with these geese I think it very likely indeed that I should not have been addressing you to-night; they were a godsend to us. We were more fortunate in finding sleeping-accommodation, for we dropped upon the wreck of a ship, and fitted up very comfortable sleeping-accommodation, and passed several weeks of very stormy weather in these curious quarters. It is too late for me to go into more detail respecting the Samoyeds; a great deal might be said, not only of their language, but their traditions; also of the many ways in which the reindeer are so extremely useful. I will only conclude by saying how greatly interested I have been in the account we have heard this evening, and which I am sure you have all shared.

Admiral Sir E. Ommanney: Having navigated every part of the White Sea in 1854, in the Russian war, in command of the naval force, I will make a few observations, although the conditions of that sea are very different to the Arctic Ocean surrounding the island of Kolgueff. I wish to ask Mr. Trevor-Battye whether the Atlantic Gulf Stream exercises any influence around Kolgueff, also whether any heavy polar ice drifts down to that island. Being war-time when I landed at various places in the White Sea, my visits were generally of a hostile character, which depended very much on the manner of my reception by the natives. As allusion has been made to the attacks from mosquito swarms, I may say we found them very formidable and irritating defenders of their native land. Our only sheltered anchorage was near Cross Island, at the entrance of the White Sea, where we procured fresh water from the rivulet on the mainland. The boats' crews employed in watering returned on board with their features so much swollen by the stings of mosquitos as scarcely to be recognized. Much praise is due to our adventurous yachtsmen, who prosecute the hazards of Arctic discovery. It was a fortunate circumstance which landed our lecturer on this unexplored island, who brought us such important information as a naturalist, also on the geology and geography of Kolgueff. Mr. President, you will agree with me in saying that Kolgueff is the land of plenty as compared with the Arctic region, where we passed eleven months, including the winter of 1850–51, which was comparably destitute of animal life.

Mr. Trevor-Battye: May I say—in thanking Mr. Seebohm for the kind way he has spoken—that no one is more conscious than myself of the extremely inadequate nature of the paper? I am afraid I rather over-calculated the amount of time I should be able to devote to it. Although I have necessarily been obliged

this evening to keep very much to geographical details, I of course made, during my stay on Kolgueff, many observations in natural history, and have many notes on the birds. When I have an opportunity of publishing these, I shall hope to describe the big goose-catch to which Mr. Seebohm refers.

The PRESIDENT: Mr. Trevor-Battye has given us a very clear and, I should suppose, exhaustive account of the physical aspects of the flora and fauna, and of the interesting Samoyedi inhabitants of the island of Kolgueff. To students of Arctic history, Kolgueff is a classic name. When Sir Hugh Willoughby undertook his voyage in 1553, and discovered the coast of Novaya Zemlya, he plied to the north for two days, and then south-south-west, until he sighted low land, which I have no doubt was Kolgueff Island. We then read of Stephen Burrough, the future chief pilot of England, passing the shores of Kolgueff Island to his left, when on his way to the strait, now often called the Kara Strait, but which ought to bear the name of its discoverer, Burrough. If I remember rightly, he mentions having seen a great number of curious wooden idols, like those obtained by Mr. Trevor-Battye, and it would be interesting to think that one of the images now brought home was seen by Stephen Burrough, possibly handed down from father to son. Then we read how Arthur Pett and Charles Jackman, in returning from Pett Strait, managed to get their little vessels of 20 and 40 tons respectively on the sand of the southern coast of Kolgueff Island. There are many other incidents in Arctic history connected with this island. I think we should also remember that in his interesting description of these northern shores our great poet Milton mentions the island of Kolgueff. Many memories are connected with it, yet it was only a classic name to us until it was clothed with living interest in the charming paper we have just heard read. I now propose a vote of thanks to Mr. Trevor-Battye, and I feel sure it will be carried by acclamation.

I have an impression in my own mind that Mr. Trevor-Battye has the stuff in him which goes to make a great traveller. I feel sure that if he is spared it will not be many years before he comes back to us, and appears before us in this room after having achieved some other greater geographical piece of work. I shall have that belief in my mind when I convey to him your thanks. I have now great pleasure in thanking Mr. Trevor-Battye, in the name of this meeting, for the very interesting paper he has read to us.

AN ARTISTIC EXPEDITION TO THE NORTH POLE.

By JULIUS v. PAYER.

PAINTERS are asking for new material on which to exercise their art. What can there still be that has remained hidden, as by a miracle, during two thousand years of skilled workmanship? This material must all belong to the earth; is it yet completely explored from an artistic point of view? No. This is only the case with its civilized states; beyond them some great master has now and again ventured a step, not without a misgiving that he has thereby quitted the legitimate sphere of art. And yet how small is the matter for artistic reproduction in the old civilized world compared with the rest of the globe! Has the desert been depicted in such a manner as it undoubtedly deserves to be? Or the Tundra, the primeval forest of the Dark Continent, the swampy shores of Lake Chad, the bridle-path of the Cordilleras, the

Tibetan mountain-lake, or the Coral Islands? What of the animal world, if we except our domestic animals and some wild game—the Indian beasts of prey, the African pachyderms, the troops of monkeys or tortoises of Brazil? And then the scenes of human activity—the negro battles, the dreamy still-life of the South Sea Islanders, the buffalo-hunters, Yakuts so hardened as to sleep almost naked in the snow, indiarubber-collectors on the Amazons, Patagonian giants, Niam-Niam dwarfs, etc. Here is material enough for the twentieth century, which will perhaps bring us discoveries which may facilitate the world's intercourse in a manner still undreamed of.

Whether the aërial ship, for the construction of which so many have striven in vain, will be a *fait accompli* in the coming epoch, is still doubtful; and yet in my opinion it is only by an aërial route that a region can be explored which remains less known and less accessible than any other part of the earth—the North Pole. The few navigators who have penetrated into those regions have been so occupied with the details of ice-navigation, that they have been able to pay no attention to the artistic beauties of the North Pole, surpassing though they be. The impressions which I received there were overpowering, and caused me deep regret that I was unable to reproduce them. The drawings with which I illustrated the account of my voyage, though of some use as an explanation, could give but a remote idea of the phenomena to be depicted. I have, therefore, devoted myself to painting, and have been so fortunate as to achieve some success with my North Polar pictures, "Starvation Cove," the Franklin series, "Never again" (a tribute to the memory of my deceased friend Weyprecht), and others. But even in the execution of these pictures, I experienced an oppressive feeling of insufficiency, of inability to worthily depict the richness of nature in the Polar Regions. The conviction forced itself upon me that this is to be represented in all its variety—known to but few—only by actual inspection.

Long had the erroneous idea prevailed, with regard to the nature of that region, that it was formed of nothing but snow; that, "white, ever white," it formed a frozen plain, over which a grey sky brooded. Whence is this description derived? In the first instance, from the repetition of the Old-World tale of Herodotus, of the horrors of the Scythian winter, and the land of the Anthropophagi, wrapt in a murky snow-filled atmosphere. Of just such a frightful aspect did the Arabs picture to themselves even the south of Siberia; the would-be voyagers to the Indies through the ice heaped up new prejudices; and if these had remained without confirmation, it was supplied by the illustrations of English and American North Polar navigators. Who had manufactured these illustrations? Draughtsmen in London and New York, who had never seen the lands to be depicted, and who, therefore, could but depend on tradition, according to which even the Alps were held

to be without beauty, and even hideous. Thus the belief crystallized more and more, that the North Pole was a frightful desert, devoid of every artistic charm, almost of life. Times without number have I encountered the utmost astonishment, even among educated men, when I have unfolded the true picture of the far North.

What I could do by word of mouth with individuals—without thereby shaking the general prepossession—I could only partially accomplish with the paint-brush. I felt my inability to conjure up from fading memories that which I had admired merely as a layman; as a layman, that is, unpractised in analytical methods, which are possible to an adept alone. Never, therefore, did I satisfy my craving to picture the vast, the mysterious, the fantastic, or the tragic (though these still remained fixed in my memory), and I confined myself, without thereby deviating from the truth, to the dull, featureless day, which to be sure is common enough, and was of use for my historical pictures—and the artistic variety of the North vanished meanwhile. Thus even I helped by my pictures to intensify the prevalent notion as to the appearance of the Polar Regions, and not without self-reproach did I hear, as the echo of the impression conveyed, "Well, monotonous and desolate it is up there, even as it is here depicted, nothing but ice and snow."

The artistic consists in change, not in gayness of colouring, and the greatest effect is produced by little colour, even a monotonous view gaining life from charm of light. Yet there is no monotony at the North Pole. I have spent nearly four and a half years in those regions, ever entranced by the change in the picture of nature. What a magic spell, for instance, is produced even by the twilight—that of spring, but especially of autumn; the time without bright light, almost without shade; that of the soft, dreamy silhouettes, of the clear green sky, and the pale silvery tone of the mountains! The snow is now melted, and the blue sea-ice lies bare, scarcely tinged with red by the setting sun. Even the long winter night possesses its artistic charm from the midday arch of light, or the moon which changes the channels beneath into rivers of silver. The arctic sky alone would enrapture the painter. As the returning sun nears the horizon, every colour glows forth, a border of light dividing the part of the atmosphere still in the shadow of the earth from that already lighted up; while the sun's return is accompanied by those refractions of rays and atmospheric reflections, or *Fata morgana*, about which we still know so little.

Before a change of weather, or a storm following on severe cold, the refraction is such that no confidence can be placed on the apparent size or position of any object. Ice-blocks may present the appearance of tall pillars or ruined towns; ships beyond the range of direct vision may appear twice, thrice, or four times repeated, and mountains are seen double or treble their real height, and constantly changing their form. The sun is visible days or even weeks before it actually reaches the

horizon, and exhibits remarkable appearances, the most seldom being that in which numerous false suns are grouped round the true sun in the centre, as many as twenty being sometimes seen in concentric circles, all connected by glowing rays with the central point. All these phenomena display prismatic colours in an atmosphere filled with ice-needles and frost-nebulæ. If the temperature sinks to 40°–60° below zero, the red disc of the sun, enormously exaggerated in size, hardly breaks through the vapour; everything appears far off; men are in a moment covered with hoar-frost, and their breath envelops them in clouds of mist, on which their shadow is distinguishable edged with yellow. If a rift opens in the ice, white pillars of frozen vapour arise like a huge fountain, scattering snow-dust around. In the midst of it all prowls the ice-bear, aroused from his winter sleep, a never-resting wanderer.

The sun mounts higher. The snow-fall ceases, and the moisture arising from the sea condenses on the mountains into a covering of ice, tinged by the sun, still low in the sky, with a wonderful orange and rose—an alpine glow lasting for weeks! All is warmth and luxuriance, the exact converse of the autumn twilight. As the temperature passes the zero-point, dusky water-vapour broods everywhere over the icy sea, dark as in a total eclipse of the sun. The snow-covering of the ice-blocks melts, and large cold ice-lakes are formed, traversed by dim phantoms of snow-ridges. It is a good picture of the nether world, often sublime, but at the same time desolate and depressing to the ship-wrecked mariners, who drag their sledges, up to the hips in the water of a shallow sea, surrounded by unseen chasms.

The "ice-blink," a refracted light from impenetrable pack-ice, while it gives warning to travellers in search of open water, serves also to enhance the beauty of the scene. When the sun has reached its culminating point, a dazzling clearness of the atmosphere ensues, light fleecy clouds float across the deep blue sky, the sea becomes ultramarine, and above it icebergs rear their heads aloft, sea-birds hovering round in swarms, while their whole mass glows at times in the northern light. Only at the margin of the ice does the restless surf beat, audible even when invisible.

The land, they say, is never free from snow, for so have the illustrations always represented it. But, though the so-called snow-line is said to coincide with the sea-level in the Polar lands, wherever in summer the temperature rises ever so little above the freezing-point, there is no snow covering, however low the mean for the year may be. By April the sugar-like covering of the rocks disappears; in May no more snow lies on the plains; and in June there are extensive pastures, which supply food to herds of reindeer and musk-oxen. Although there is never the thick flora of our meadows, yet one meets with limited areas, either yellow with *Papaver nudicaule* or *Ranunculus*, or carmine with *Silene* or *Saxifraga*, or blue with forget-me-not, or white

with *Cerastium*. Owing to the long Polar day, altitude affects the vegetation much less than in Europe, and the mountain slopes, on which the sun's rays fall almost perpendicularly, often show the richest carpet of flowers. It is not so much the cold *per se*, as its long duration, which limits the Arctic flora. As soon as the sun ceases to set, the snow melts as by magic, the plains are converted into bogs, while the hot oppressive air is filled of an evening with swarms of mosquitoes. The greenery imported by the vegetation lasts late into the autumn, the temperature of which far exceeds that of spring.

East Greenland, in particular, is of great beauty. Its huge Kaiser-Franz-Josef Fiord surpasses Norway, and may be compared to the Pennine Alps, supposing the valleys were filled with water. With a greenish landscape on the margin, rocky walls above reaching to over 6000 feet, and mountains behind to 13,000 feet, it forms one of the most majestic scenes in the world, whose beauty I have never seen surpassed. South of Cape Franklin are mountains just like our famous Dolomites. North-east Greenland, too, is an Arctic alpine land; Spitzbergen has a profile like a saw; Novaya Zemlya is a tableland, buttressed by mountain cones; and all these lands enjoy the most delicious invigorating atmosphere, free from miasma and germs of disease.

In this sketch I have not exhausted, but only indicated, the variety of Arctic natural phenomena. I have said nothing of the life added to the picture by the animal world, or the peculiar mode of existence of man in those regions. But enough has been said to support the conclusions I wish to draw.

The above scenes have never been depicted by an artist; nay, we know almost as little of them as if they belonged to the moon. Shall it never be otherwise? Would an exploration by the paint-brush be less glorious than the discovery of new lands? Would not a scheme be worthy of recognition and patronage, which should be devoted to the faithful representation by pictures of an unknown world, serving thereby knowledge and science? Yet this end could never be attained without an expedition sent expressly for the purpose.

Filled for years with the idea of a picturesque exploration of the Polar Regions, I have set myself the task of calling into being *a new North Polar expedition* with artistic objects in view. It is Count Wilczek who, by commissioning me with the execution of a colossal picture of the North Pole, has again, as in 1871, caused my ideas to take a tangible shape. It is planned that such an expedition as I have described shall be sent out by Austria-Hungary.

By far the most tempting objective of such an expedition would be North-east Greenland, the most picturesque region of the North, and by pushing on along the coast of East Greenland towards the Pole, one would reach a region of the greatest contrasts and effects, which increase

with the latitude. And as we did not before explore further than the 77th degree, each step beyond would at the same time be a geographical discovery. It is true that for this a great expenditure would be necessary, so that I must also keep before me a less distant goal, and perhaps set on foot a sort of preliminary expedition, the results of which might still be important. No one can recognize the difficulties more clearly than I do myself; but I do not consider them insurmountable, and my previous experience will guard me from entering on the task insufficiently equipped. I have the fullest confidence that this new Austro-Hungarian expedition will take definite shape, even with the ambitious programme which I have suggested.

The plan of the expedition which I propose to lead would be somewhat as follows. A new steamer of 400 tons (200 horse-power) would be built, and manned with Dalmatian seamen, with three qualified officers, besides experts, engineers, Tyrolese marksmen, etc. To carry out the main object, painting, I would take also two landscape-painters, one animal-painter, and a photographer. A central studio would be erected at the winter quarters, and movable glass studios would also be taken for use both on deck during the summer and at special localities. All would be capable of being heated, and of being lighted by electricity supplied by benzine or petroleum motors. A captive balloon might also be used as an aid to study. Studies and pictures would be taken in great numbers. Drawing I have found possible by the hour even at a temperature of 50° below zero, and by moonlight, the northern light, etc., as well as by daylight. Painting is more difficult. When impossible on deck, I used to descend into the cabin after each inspection of the view; but with a suitable studio this would be avoided. An oil which remains liquid at very low temperatures would be used instead of oil-colours. The studies would remain unaltered, but their subjects would be worked up into pictures on the spot while the impression remained fresh. The work would be more difficult, but not impossible, on extended sledge-expeditions. At times one would be limited to putting down the proper colours, while photographs taken at the same time would show their proper arrangements. Hunting and other episodes would naturally be depicted afterwards on board ship. The glass studios would have to be tested beforehand in an exposed situation as regards their power of resisting snow-storms. A large proportion of all the studies would be taken, however, at a temperature above the freezing-point.

The naval officers would carry out the meteorological and magnetic observations, while a naturalist (a doctor at the same time) would collect everywhere. Cape Franklin, at the entrance of the little-explored Kaiser-Franz-Josef Fiord, would recommend itself as the first winter quarters. A mass of rock nearly 6000 feet high is surrounded for miles by a grass-covered undulating country, in which I have seen herds of

fifty or even a hundred head of reindeer. The fiord could be explored in summer and, if means allowed, a detached winter station could be erected in the interior in telephonic communication with that of the ship. Nowhere else in the Arctic regions is the chase so productive as at the mouth of this fiord, a bear, reindeer, musk-ox, or walrus, or perhaps all four, being probably met with in the course of a few hours' stroll, and there should be no lack of fresh meat. Besides shooting the game, the Tyrolese marksmen might do good service by ascents of mountain peaks, which help so much to a knowledge of the configuration of the country.

The crossing of the stream of pack-ice in order to reach East Greenland is best accomplished in about 74° N. lat., as was done by Clavering in 1823 and Koldewey in 1869-70. It is true the ice of that stream is the heaviest in the world. There are masses along which one may steam a whole day together, and whose lofty surface cannot be seen from the ship. On whatever coast seals or walruses are found, there Eskimo can live, and though no one but Clavering has seen them in East Greenland, it is quite possible that they may be still settled there.

The cost of the expedition, which is to start in June, 1896, is only in part covered, and it will not be slight. There will be no lack of volunteers, for happily there are always men ready to incur risk to serve a great end. The dangers and hardships are great, and more than a passing enthusiasm is needed to induce men to encounter them—the steadfast purpose of the scientific inquirer, and the irresistible impulse of man to become acquainted with the globe in every direction. My expedition is inspired by this ever-fresh ideal, the same which influenced Holzendorff when he wrote to me respecting "Starvation Cove:" "North Polar voyages are among the most striking manifestations of human civilization."

CRATER-LAKES NORTH OF LAKE NYASA,

With a Suggestion as to the Origin of Central African Lakes.

By Dr. D. KERR-CROSS.

Last year (1893), accompanied by my wife, it was my privilege to travel for a month on the hills north of Lake Nyasa, in British and German Central Africa, and to visit some new country, and to see some small volcanic lakes of which I had for long heard. The country to the immediate north of this lake is not only interesting in itself, but it is the border country between the spheres of influence of these two great European Powers.

The Songwe river, which divides the two spheres, is quite an arbitrary division, and runs through the country occupied by *one* great tribe. This tribe is known to the outer world as the *Wa-nkonde*, but by

the people it is divided into several families or tribes. With some pronounced differences, they speak one language, and have the same characteristics in customs and dress. Some occupy the plains skirting the lake, others the plateau, while another section is distinctly a hill people, and is found in Wundale and Mesuko. The Wa-nkonde section was that first visited and influenced by Europeans, but we now know that of the five families this is the least influential. The people themselves divide their tribe thus: around Karonga and south of the Songwe river, the *Wa-nkonde;* from the Songwe to the Kinga (Livingstone range) mountains skirting the lake, the *Wa-nyakyusa;* directly to the north between the Kinga and the Wundale Mountains to the west is an extensive amphitheatre occupied by the *Wa-kukwe* people; the Wundale Mountain country is occupied by the *Awa-bundale;* while north of the Songwe river, still in hill country, come the *Wa-mesuko* people. Few travellers have visited the two last-named families of the tribe, as their country is extremely mountainous, but they are a most interesting people, and quite as numerous as any of the other sections.

The Konde country proper is that plain skirting the north of the lake, which is shut in by the steep slopes of the Henga mountains to the west, and the Livingstone (Kinga) mountains to the east. It does not include the mountain country west and north. This plain is in the main a dead flat, and has been laid down by the Nyasa. In the rainy season, great stretches are under water, and it is only habitable in certain localities which rise above the general level. It is, however, very rich, being watered by six large rivers and very many small streams which come from the hill country. A great change is coming over this plain, owing, as the natives say, to the "drying up of the lake." Yet the Nyasa must have occupied its present level for a very long time, as there are found huge báobab (*Adansonia digitata*) and banyan (*Ficus Indica*) trees quite near the edge of the water, and these, according to most authorities, indicate at least the sameness of level for several thousands of years. Still, to all who for some years have lived on the lake shore, there is an obvious fall of between six and ten feet, say, within the last ten years. When I first saw Karonga it was one great banana plantation; now, owing to the decrease in the rainfall, and the fall in the level of the Nyasa, this plant does not grow in anything approaching its former luxuriance.

Having skirted not far from the lake shore the whole of this extensive plain, we began to ascend to the hill country, going through "mwankenjas"—large and lovely villages. The Livingstone range of mountains, as a colossal wall of thousands of feet, towered on our right. Not until we had reached the hills and found it impossible to return, did we ascertain that we had passed two small *volcanic* lakes; and, as we had the pleasure of visiting others of a similar nature, we conclude they are all of one series. The two small lakes are named

Kingire and *Ikapa*. They are said to be about five hundred yards across, and abound in fish and hippopotami.

Half a day's climbing brought us to the country overlooking the Nyasa, and occupied by the Wakukwe people. The country here is called *Nseria*. Here the German missionaries have settled, and begun a noble work. I can only speak of these men in terms of the highest praise. They belong to the Lutheran Church in Berlin, and already have opened four mission stations—one on the lake shore, and three on the hills.

Standing here, about 2500 feet above the lake, you obtain a magnificent view of the Nyasa. The Livingstone range towers in sheer escarpments to the east of us; away to the west, as a dim rugged line, you can descry the Henga mountains, with Mount Waller to the south and west. The Nyasa, far beneath, stretches to the horizon; while the Nkonde plain, distinguished by trees, lies below at our feet. The Lufisa river is here very much larger than we had anticipated. Near to Wangemannshöhe, the Berlin Mission station, it would be 100 feet broad, with a very rocky bed of huge boulders, a very swift current, and no bridge. The missionaries have been cut off from the outer world for weeks, being unable to cross.

In its physical structure the country through which we are now travelling is entirely different from any other in Nyasaland. It is decidedly volcanic. The Livingstone (Kinga) range to the east consists of ancient crystalline rocks—quartzite, hornblende, and magnetite, and, as we now see, it runs north-west by south-east, joining one side of an extensive amphitheatre. On the west is the mountain country of Wundale. These two mighty ranges of mountains close in towards the north, and leave a natural hollow undulating plateau, with its face towards the lake. It is in this amphitheatre that the volcanic lakes of which I have spoken are to be found. The whole country is typically volcanic. There are conical mounds, extinct volcanoes, cinder-beds, streams of basaltic lava, hot springs with sulphur and sodium. The cones are as fresh and as typical as the extinct volcanoes of Central France, near the Puy de Parion. The Kiunguvuvu lies in the bosom of a giant cone to the west of the Lufisa river. Bananas, bamboos, palms, and creepers grow in wild profusion. The vent itself consists of an ironstone. The water was sweet and good, and fish and tadpoles abounded. On one side we saw a little stream or spring trickling into the lake. The lake had no outlet, but inasmuch as several streams rise on the side of the cone, we have indications of underground currents. In diameter it would be about two-thirds of a mile, and the natives say it is very deep. In the early morning, as we stood on the edge of the cone and looked down on the dark circle of water as it mirrored the green foliage of the bananas and the fronds of the palms, we were quite charmed.

Lake Itende we also visited. It is higher up on the summit of another mountain near the Mbaka river. We came on it quite suddenly as we climbed on our way to the Kisiwa, another lake of which we were in search. Not a creature was near, and the oppressive silence was only broken by the shriek of the wild duck. We went down into the basin, and lunched under a giant tree on the edge of the water. Water-lilies of various colours were abundant. Looking south towards the Nyasa, we saw another small crater-lake, the Itamba. It lay like a great circular mirror, set in the midst of dense bush. It is on the east side of the Mbaka river. We had only gone a little way round the hill on which the Itende lies hidden, when we saw another small lake, the Kisiwa. We were in the neighbourhood of volcanic lakes. Before we reached this last, however, we had to make a descent of nearly 1000 feet towards the Mbaka river. We crossed the river, and ascended a lovely wooded country for a couple of miles, when we stood on the shores of the Kisiwa. The word "Kisiwa" in the Ikingonde dialect means a fountain, and often this term is applied to each of the series of lakes; so this beautiful little lake is nameless. It is about a mile in area, and is volcanic; but judging from the cone being less defined, I should say it is vastly older than the others. I find that the Kisiwa is the lake visited by Elton and Cotterill in 1879, and by Mr. Thomson. The last lake of the series was the small crater-lake on the summit of Mount Rungwe, which I also visited.

Two mountain spurs rise from the amphitheatre—the Kieyo and the Rungwe. They are both volcanic. We did not climb the Kieyo, as it looked so cold and uninviting. We spent two nights at the Berlin Mission station on the slopes of this mountain, and so excessive was the cold, we could hardly sleep! The mountain for certain months of the year is shrouded in mist. It has, I am told, the characteristic hollow on its crown, but no lake. It is well wooded.

In company with the Rev. Th. Richard, of the Moravian Mission, I climbed the Rungwe mountain. It rises to a height of fully 9000 feet, and is well wooded throughout. At first we trudged on a moorland of bracken and fern, and even moss, with wild thyme in abundance. Compositæ, as the genus Helichrysum and Cynarocephalæ, were found in great numbers at certain altitudes. These latter gave us some annoyance as we scrambled up on hands and knees. The sight of brambles (*Rubus fruticosus*) made us think of days of long ago. The varieties I have met with in Africa are those with white fruit, and not red. Three species of bamboo grow at the north of Nyasa, and it is from one of these—the *Rungwe*, which abounds on the hillside—that the mountain takes its name. After some hours of heavy climbing through undergrowth and thorny thicket, we emerged on a grassy hillside—the grass of which grew markedly in tufts—and looked from a height of 9000 feet over an undulating grass land stretching towards the Nyasa.

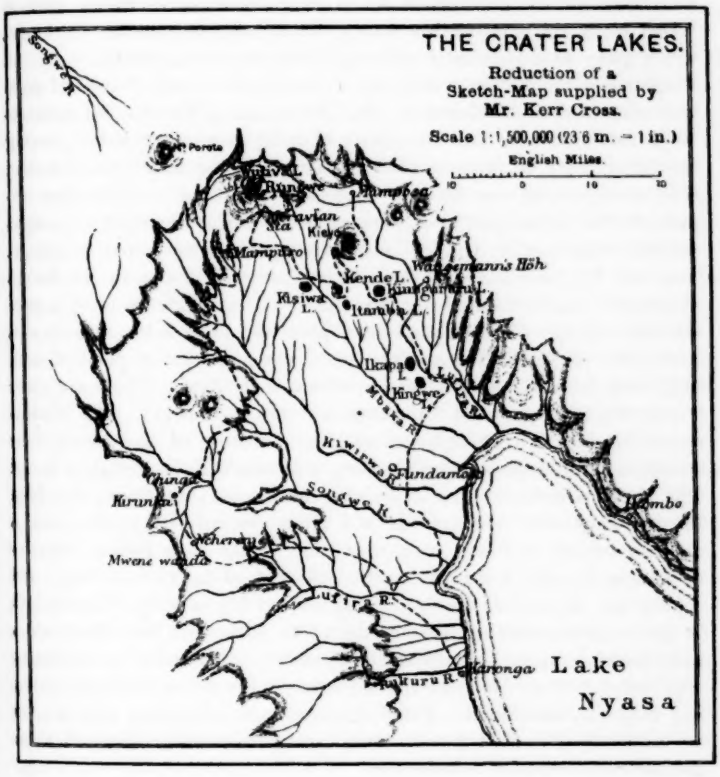
Rungwe is a typical volcanic mountain. An enormous mass rises in a cone, or several cones, with hollows, or remains of hollows, on its crown, and gentle slopes stretching away from its side. We found the seventh lake of the series occupying a hollow on its summit. It is two-thirds of a mile in diameter. It contained little water, and the surface lay about 500 yards below the rim of the crater on which we stood. Wild duck swam about freely. Several springs were observable on the sides of the crater; but there was no outlet. A kind of reed, of which the natives make sleeping-mats, grew in abundance. No fish are found, although the water was said to be drinkable. Frequently we were enveloped in mist, and only occasionally did we get a glimpse of the country around and below us. It was bitterly cold—a damp cold. The name of the lake is Wutiva.

Three rivers which run into the Nyasa rise on the slopes of this mountain mass. (1) The Lufisa rises from the north and east, and flows round to the south, receiving innumerable streams from the Kinga mountains. (2) The Kiwirwa rises on the north and west, and flows round to the south, receiving streams from the Wundale mountains. (3) The Mbaka river flows from the south face of the mountain, and receives streams from the plateau itself. Lava-beds are very distinct, as they slope from the mountain summit, and are not much cut up by weathering. Indeed, some of these cannot be mistaken, as they are so marked in their abrupt ending. The molten mass has gradually become more and more consistent and consolidated. Few of the natives have been on this mountain summit, for it is looked upon with awe and dread. Some say that long ago, when they were forced to climb with their cattle during war, they saw the lake, and in the woods heard people speaking and children crying; now the general belief is that a tribe of "heavenly people" resides there.

The soil of this amphitheatre is extremely rich. Speaking generally, it is a dark loam; in some places it is a soft pumice-stone, intermixed with a reddish loam. It is very easily wrought. What tends to its richness is the consistency and regularity of the rain-fall. Scarcely a month in the year passes without rain, and sometimes not a week. The *wet season* here is defined, not by rain falling, but by its coming every day, and coupled with the fact that it is also falling on the plain. From observations taken during several years, rain falls on an average 170 days out of the 365. The barometer stands at 25·000. There are certain places where the rain is excessive, as near the Kieyo mountain. There the natives do not cultivate at the beginning of what is known as the rainy season, *but at its close.*

So much for the *country*. Let me say a word about the people—and what I say refers to the various sections of the tribe. I doubt if *finer villages or better-built houses* exist anywhere in uncivilized Africa than are found among the "Wa-nyakyusa" people. Round

houses are occupied by the married people; but they also build *square* houses and long cattle-folds—the "kiwaga." The walls are of bamboo set into the ground at an angle of about 100°. Small bricks—"amapamba"—about the size of an ostrich egg, are fitted neatly, while plastic, into the framework. The whole is a huge basket of bamboo reeds and mud. The reeds on the roof are tied in wavy lines in the



form of a dome, and the thatch is laid with great skill. What is more, the house is scrupulously clean! Large villages are uncommon; but on the plains one village adjoins another by banana groves, which often extend for miles. Trees, too, are often their pride, being planted both for utility and ornamentation. They will point out particular giant trees, and assure you that they were planted by their fathers to indicate divisions of the land. There are no stockaded villages, although I have seen a kind of poisonous cactus growing as a defence. Their cultivation,

too, is remarkable. All manual work is done by giant hoes. The fields look as if they had been deeply ploughed, and every furrow is perfectly straight. They are a tall, muscular race. It is a treat, from an anatomical point of view, to see the development of these "men of nature." Head, face, thorax, limbs, are perfect; even their teeth are pearly white, for they are always rubbing them with a soft, fibry wood. They have scarcely got beyond the "fig leaf" stage, and are not likely soon to adopt that civilization which produces a native with a yard of soiled cloth worn round his waist. Their neighbours, the Wa-kinga, are a puny race physically, although they are true mountaineers; and I never saw the adductor muscles of the thigh so well developed as in this otherwise ill-developed people. Every man (Wa-nkonde) seems to be innoculated with the free spirit of independence prevalent among the inhabitants of mountainous districts. Their wants are few, and from strangers it may be said they desire nothing. Cloth they appreciate, but have little idea of its value. They are in what one might call the "Brass-wire Age." This is their gold, or medium of exchange. You can buy anything for brass wire. Iron is found in the Kinga mountains, and is extensively wrought. The ironstone is of a pure whitish variety. They make iron, copper, and brass belts as thick as a man's little finger, and wear them on the waist. Six or more of such belts may be worn on the person of one individual. These are their "manyeta." Their word for riches is "iron"—"ifiera." The Nkonde spears are famed. Though not so large as those of the Masai, their spears and bill-hooks are cruel-looking weapons, with long-shaped barbs. The shafts are made of a dark, hard wood, and are frequently dyed black. They are ornamented, and often beautifully inlaid with a delicate tracery of brass, copper, or iron. They have fifteen varieties of spears, bearing different names. Beyond abundance of brass and copper and iron wire, they go almost nude, while a strip of bark cloth is the modest attire of their women. In their own way they are a hard-working race, but absolutely ignorant of restraint or consistent application. They are kindly, good-natured, courteous, and hospitable; but they are unreliable. Their promises are worthless, and are, of course, freely given. I repeat, their faults are unreliability and utter indifference to outside influence.

Mutilation and other barbarous customs so often practised in Africa, and above all amongst the Wa-wemba (Ba-bemba), are seldom resorted to here. You rarely or never see a man who has lost his eyes, or lips, or hands. Slavery is not in existence in the tribe, not even in its domestic form. Hitherto they have resisted all Arab influence. Only on one occasion, when their great chief, Chungu, died, have I heard of people being buried alive. Despotic chieftains are unknown, and government is invested in the chief and his councillors. Woman is accorded a very high place, and, although she may not rule, she has most of the legal

rights of man; and the principal wife, or "mwehe," of the ruling chief, is a personage of considerable influence. Formerly cattle abounded, but eighteen months ago these were nearly swept away by the plague of anthrax, which devastated the African continent in its central portion. We passed through many villages where the long cattle kraal was falling to decay. Elephants, zebras, varieties of deer, are found in certain localities, and at one time enormous herds of buffalo were seen roaming over the plains; but these, like the cattle, have now almost disappeared. The superstitions and beliefs of the people are interesting subjects, but I will only mention two or three, which struck me as peculiar. In various parts of the country, and often on the crests of rounded mounds of considerable size, are to be seen clumps of thick forest. There are their "isyeta," or sacred groves, or burial-places of their ancestors. The undergrowth is so thick that the sun's rays seldom penetrate. In their days of trouble, the "waputi," or priests, resort there to pray to the spirits of their fathers. In these the prophets, "awaraghusi," deliver their messages. No other living creature is allowed to enter. Should war or disease visit the tribe, the "mputi" kills a bull, and offers the blood and the head of the animal. They firmly believe in the spirit of evil; he is "mbasi." In one place Mbasi is a person—an old man—who exercises extraordinary power. He only speaks at night, and to the head-men of the tribe, and during the interview every other voice must be silent, and every light extinguished. In Wundale the people believe in such a person, who has the power to make lions, and who makes use of them as messengers of evil. His home is surrounded with long grass, in which he keeps his lions, as other men keep dogs. If a man has a dispute with his neighbour, who refuses to come to terms, these lions may be hired to destroy his cattle!

I was much struck to find that all over the north end of Lake Nyasa the people regularly perform a *post-mortem* on their dead. Death in war is the only exception. One of the elderly men takes a strip of bamboo, and makes an incision in the abdominal wall below the ribs, and carefully inspects the viscera. They bury immediately outside the door of the house, and in a sitting posture. In Wundale, about a year after the decease and at dead of night, the friends lift the bones and cast them into certain clumps of trees, found all over the country. These groves are full of human bones.

Formerly, the whole of the north of Nyasa was under the despotic rule of Merere, the chief of Usango. For long, however, this tyrant has been gradually losing his power. Every section of the people has its own story of the struggle with the hordes of warriors that came from the north. Now he has entirely lost his influence with the lake people, and confines his raiding excursions to the tribes round Mount Rungwe and the Kieyo. Some twelve years ago his greatest warrior was killed near the lake, and he has never since regained his power. This warrior

was believed to be proof against the spear. He was taken captive, however, and dragged before the chief Mwanjewara, when a thousand spears were hurled into his body. As late as September, 1892, 600 of Merere's fighting men came down to the neighbourhood of Rungwe. On their appearance the people fled to the hills, and, with their cattle, took refuge in caves and inaccessible fastnesses. Merere's men followed, when the fugitives hurled stones down the steep slopes, and killed many of the men. This so discouraged the invaders that they left the country. This is Africa!

Leaving this interesting amphitheatre, we travelled due west by south in the mountain country of Wundale. I am right in describing this as a mountain country. It is a continuation of the Henga and Mesuko ranges. Wundale—*ntali* means "high" or "tall"—proper consists of a series of mountain ranges running due north and south, with valleys opening towards the Nyasa. It is 30 miles in breadth and 50 or more in length, and maintains a level of from 5000 to 6000 feet above the sea, with two peaks, Mwasewa and Nyembere, which rise to 8000 feet. The soil differs from that found in the Kinga mountains or the Ukukwe plains we have just crossed. The rock is typical granite, with its felspar of the orthoclase pink variety. The glassy lustre of this potash felspar is very apparent, and the pink colour gives a red tone to the soil and subsoil of the country.

In approaching this mountain country we crossed the Kiwirwa river. This river, as I have already said, rises from the north and west faces of Rungwe, makes a wide sweep, and runs due south, receiving streams from the east face of the Wundale mountains. We crossed this river by a natural bridge of a most interesting nature. The river here runs through a series of wild glens twenty miles in length, and exhibits all the rugged grandeur of mountain scenery. The river itself is nearly 100 feet broad, and plunges through glens and cascades and gorges adorned with tropical vegetation. As we stood near the bridge referred to, we saw two waterfalls within a mile of each other in the course of the river. Two enormous blocks of basaltic rock hurled from the distant hills have fallen across the water, and lean one on the other at an angle of 45°. They thus span the torrent as it sweeps below.

Leaving the Kiwirwa river, we entered Wundale proper, and had two days of very stiff climbing. Cattle were seen everywhere, for the anthrax was less severely felt in these uplands. We climbed until we reached grassy mountainous country 4500 and 5000 feet above the sea. Then we made a sheer descent of fully 1000 feet, to a wild mountain torrent named Kawaka. This stream, the Kawaka, comes from the north, and runs into the Suwiswi river, which joins the Kiwirwa. Even in the dry season these streams convey a considerable volume of water. The descent to the Kawaka was one of the steepest I have ever

made. We had at times to steady ourselves lest we should fall forward. The Suwiswi is a broad river, and comes through the wildest of glens. We crossed it by a rickety native bridge made of bamboo. Leaving the bridge, we climbed for three hours, and emerged on a grassy height 7400 feet above the sea. Here we had another magnificent view of the Nyasa. The waves breaking on the shore were distinctly visible. To the east was the Livingstone (Kinga) range, stretching as far as the eye could reach. At two separate levels, one above the other, were long lines of white cloud—dead-level, double table-covers. Directly east we discerned Mounts Kieyo and Rungwe, but both summits were shrouded in mist. The Ukukwe plain, 4000 feet above the sea, seemed an undulating flat. Wundale is wonderfully well watered. Springs seemed to bubble forth from every hillside. In one of the larger valleys I counted thirteen sub-valleys, each with its little rivulet running to the parent stream. The houses are built on terraces dug out of the hillside, and hidden in banana groves. These latter, with their green foliage, contrast strikingly with the red soil. The people are highlanders, wild and independent, but have all the characteristics in dress and customs of the other sections of their tribe. The news of a stranger being in the valley is spread with marvellous rapidity. In a few minutes every cow is called—for the cattle are taught to follow the herd on his making a peculiar labial sound—to the deep foliage of the sub-valleys, or driven to inaccessible heights. It may be that the natives have never before seen a white man, and still less a white lady, but they look upon the caravan with the utmost *sang-froid*.

Crossing this interesting mountain country, with its deep-red soil, shy people, cattle, bananas, rain, and evergreen hills—for there are no bush fires, so characteristic of African life, up here—we descend towards the Songwe river, as it winds its way through this world of mountains, and have again reached the dividing-line or boundary between the two European spheres of influence. Here we enter upon an entirely different soil and people and mode of life. The clay is light yellow and less rich; the vegetable is much less luxuriant and tropical. Bananas will not grow, the villages are stockaded, and the whole country is poorer and not so well watered. We are now on the Nyasa-Tanganyika plateau, traversed by the Stevenson road. This plateau has been described so often, that I do not feel justified in making a single remark beyond the following. *En route* we passed a stockaded village named Kinunka, which means, in the dialect of the place, "an unpleasant odour." Near it there is a fountain 150 feet in diameter, covered with sodium and magnesium salts. Sulphuretted hydrogen is also generated, giving rise to the name of the place. On our way home we left the usual road about six miles beyond Mwenewanda's village, and skirted the Mesuko country. This latter is really another Wundale, south of the Songwe river. It is even more mountainous, but the soil is poorer. On our

way south we crossed quite a number of small streams not marked before, all of which ran to the Lufisa river.

Two facts observable on this journey set us speculating as to what could be the origin of the Nyasa and of the series of lakes—some fresh, some brackish, some salt—found in the centre of the African continent: (1) the seven crater-lakes we had now visited; (2) the fact that we had traversed the water-parting of the whole continent of Central Africa.

Within a very few miles you see the head waters of the Shiré river; of the Loangwa valley; of the Chambezi flowing into the Congo and the Atlantic; of streams running to Lake Rukwa, and not far off tiny streams which eventually find their way to the Indian Ocean.

The formation of large lakes in the centre of continents at different altitudes and of great depth is a problem of great difficulty. The "inland seas" in the centre of Africa are no exception to this rule. Africa is one of the oldest of the continents, and has seen marvellous changes from a geological point of view. The hills and valleys, the strata of sand and clay, marl and chalk, and even coal, found where they are least expected, point to extraordinary upheavals in past time. Hill and valley seem to have changed places; great rents to have opened up and swallowed whole countries, and it may be mountain ranges, leaving behind indescribable chaos.

As we reflect on their possible origin, let us recollect a few facts.

1. East Africa is a country of table-lands.

2. Its lakes, Tanganyika, Nyasa, Rukwa, Bangweolo, Mwero, and to some extent those further north—not to speak of the lesser lakes—run more or less in the lie of the continent north and south, and are separated from the sea to the east by highland, and are environed by great mountain systems remote from those of the coast range.

3. The lakes are all at high elevation.

4. Some of the lakes have evidence of great volcanic activity having taken place in late geological time. We have recently extinct craters; we have hot springs and lava flows.

5. There is a decided parallelism between the lakes and the strike of the mountains, and they occupy vast valleys surrounded by high ground or table-land.

6. The mountains consist chiefly of crystalline and schistose rocks and gneiss.

7. The number of the lakes in the centre of the continent is great; and some are salt, some brackish with sodium and magnesium salts, and some are fresh.

8. Most of them have islands.

9. Some are surrounded by markedly escarped hills, with terraces rising from them. Some of these terraces denote a former higher level.

10. In some places the lakes are said to be extremely deep. Notably on Lake Nyasa we have great variations of depth. At the south end

soundings have been made to the depth of 200 fathoms, and no bottom found. At the north and west of this lake the shore is extremely shallow, with sandy spits due to the *débris* brought down for ages by the six large rivers, while on the north-east, under the Livingstone range, soundings have been made to a very great depth without reaching a bottom. Last year, when soundings were taken at Rumbira bay, they had evidences of great heat at a considerable depth below the level of the lake.

As far as I know, no geological sections have been made of the rocks surrounding the Central African lakes, but the biological question has been partially discussed, and the specimens found are said to bear a marked resemblance to marine forms. Lately, the modifications which marine invertebrate and vertebrate forms of life undergo in their adaptation to a fresh-water life have received a great deal of attention. It is hard to believe that these lakes are of glacial origin, and that the sea did not erode them. Glaciers and ice-sheets leave their records on rocks so distinct that they cannot be mistaken. Have we any evidences of transport? any glacial *débris*? any signs of striation? Have any of the rocks left behind the smooth rounded bosses (*roches moutonnées*)? Some deny the possibility of lake erosion by stones carried on ice, or by the glacial stream. In some of the lakes there is no possibility of migration of life. If they had a glacial origin, then the fish, mollusca, and crustacea must have been introduced subsequently, for a fauna or flora could not live during the formation of a lake by glacial erosion. From what we know of the fauna, they point to another origin. The dried-up and retreating lakes all over the centre of Africa, the terraces found on some, denote a former vast extension of these lakes; the great depths said to exist make it hard to resist the evidence that these great inland waters, despite their differences of altitude (and they do differ in this respect), were once part of the sea. The fauna and flora were introduced when the aspect of nature was very different from what it is at the present moment. The sea itself could not excavate such lakes; its power of erosion is limited to a few fathoms of depth. We conclude, therefore, that the terrestrial conditions preceded the marine. These lakes were, in the first instance, arms of the sea, as the Red Sea is at the present moment. The whole continent participated in the general movements of the later Tertiary ages, such as crushing, subsidence, faulting, and upheaval, which are evident on every hand. The fauna living on during these successive convulsions gradually adapted itself to its varying environment. We know that vast upheavals and depressions have taken place to the north and east of the African continent. The Sea of Galilee is 380 feet, and the Dead Sea 1390 feet, below the Mediterranean. Here we might have had another inland sea. What is more, I understand that Nile fish have been recognized by Dr. Gunther in the Sea of Galilee. It may yet be proved that the whole of the centre of Africa was at one time a vast sea. Mountain ranges have emerged, producing great inland lakes, some of

which have become land-locked, some salt, and some, after long periods of time, have been effaced. These great convulsions in nature may have produced this remarkable series of Central African lakes, while volcanic undermining, such as is evident at the extreme north of Lake Nyasa, has added its quotum.

DR. DONALDSON SMITH'S EXPEDITION TO SOMALILAND.*

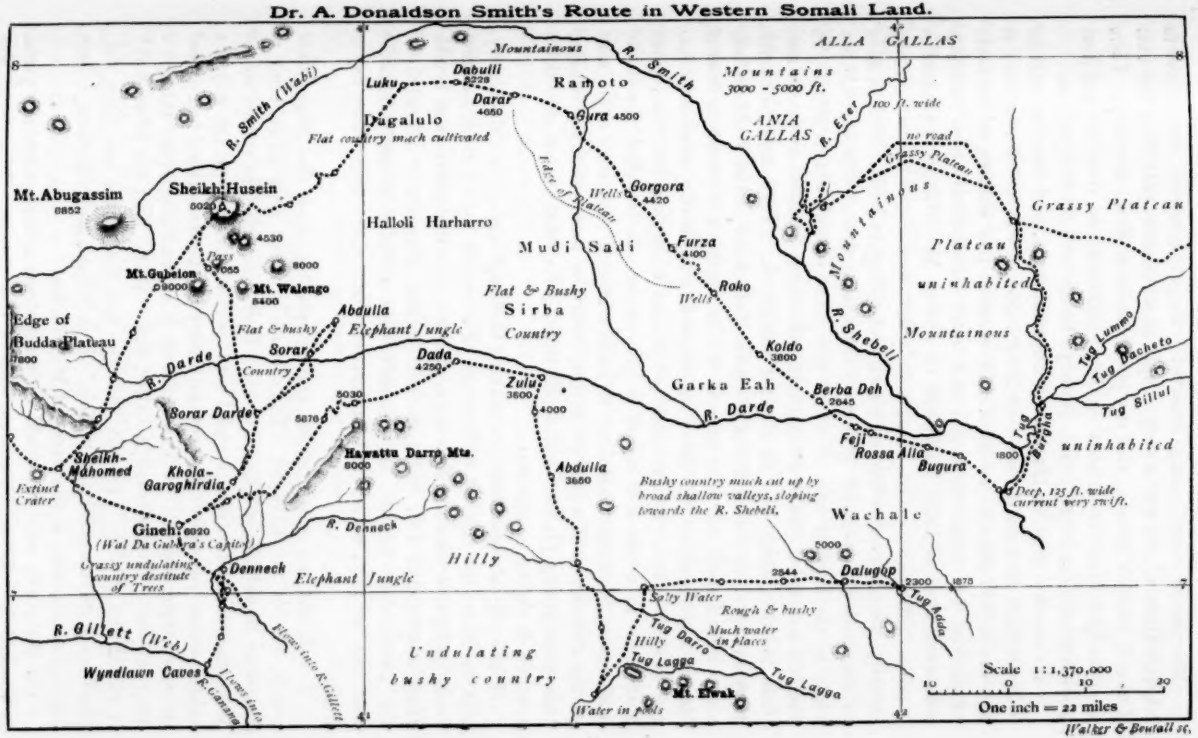
[The following communication, dated "Webi Shebeli, December 14, 1894," has been received from Dr. Donaldson Smith:—]

After leaving the Webi Shebeli, we made friends with the Arusa Gallas at once. They were not the warlike people I had expected. On the contrary, they would not believe we had crossed the river where it was so difficult, but insisted that we had come from the clouds to rid them of their conquerors, the Abyssinians. We were passed on from village to village with the greatest show of good will imaginable. There was much talk in the country about Sheikh Husein, as a place of great importance. There was a large sprinkling of Mohamedans among the Gallas, and by these Sheikh Husein was regarded as a holy city. I determined to visit this village, and go thence to Lake Dumble (incorrectly marked "Demble" on the maps).

For the first 50 miles west of the river the country presented a very dry and unproductive appearance, resembling most parts of Somaliland. We were obliged to thread our way among the mimosa bushes and acacias with the greatest difficulty, cutting a path most of the way. We ascended rapidly from the Webi Shebeli, and when we reached the wells of Gorgora there was a great change in the climate and vegetation. Cool moist air, and an infinite variety of trees, bushes, and vines. We now commenced to have plenty of rain. Threading our way along the edge of a much-broken plateau for many marches, we reached the village of Luku, elevation 5200 feet, on September 17, 1894. To the north of our line of march there was a mountain range running nearly east and west, while to the south was a great expanse of low-lying bushy country, with here and there a single mountain peak visible.

At Luku we found a tomb of one of the former Mohamedan sheikhs called Abai Azied, which was made of stone in the form of a dome, 20 feet high, resting on a huge stone base. Crowds of natives followed us all the way to Sheikh Husein, and did much to assist us in clearing a path for the camels. I was struck by the richness of the soil, and the splendid crops of durrha, maize, and other cereals raised by the natives. The country between Luku and Sheikh Husein was by far the best-cultivated land I saw on my journey, although the whole of the soil in this mountainous district would delight the heart of an English farmer.

* Compare paper and map, vol. iv. of *Journal*, p. 528.


Dr. A. Donaldson Smith's Route in Western Somali Land.
ALLA GALLAS
Mountainous
R. Smith
Mountains 3000 - 5000 ft.
R. Smith (Wabi)
Dabulli 2228
Luku
Ramoto
Darar 4650
Gura 4500
Tugalulo
Flat country much cultivated
ANIA GALLAS
R. Erer
100 ft. wide
no road
Grassy Plateau
Mt. Abugassim 6852
Sheikh Husein 5020
Wells
Gorgora 4420
Halloli Harbarro
Mudi Sadi
Furza 4100
Pass 4530
Pass 5055
8000
Mt. Gubeion 9000
Mt. Walengo 5400
Flat & Bushy
Roko
Wells
Mountainous
Plateau uninhabited
Edge of Budda Plateau 7800
Abdulla
Flat & bushy
Elephant Jungle
Sirba Country
R. Shebeli
Mountainous
Tug Lumeo
Tug Bacheto
R. Darde
Sorar
Country
Dada 4250
Koldo 3800
Zulu 3600
4000
Garka Eah
Berba Deh 2645
5030
5870
Sorar Darde
R. Darde
Tug Berbha
Tug Sillul
Hawatta Darro Mts. 8000
Feji
Rossa Alia
Bugura 1800
uninhabited
Sheikh-Mahomed
Khola-Garoghirdia
Abdulia 3650
Bushy country much cut up by broad shallow valleys, sloping towards the R. Shebeli.
Deep, 125 ft. wide current very swift.
Extinct Crater
Wachale
Gineh 6920
(Wal Da Gubbra's Capital)
R. Denneck
5000
Hilly
Denneck
Elephant Jungle
2544
Dalugop 2300 1875
Grassy undulating country destitute of Trees
Salty Water
Rough & bushy
Much water in places
Tug Adda
R. Gillett (Il'eb)
Tug Darro
Hilly
Undulating bushy country
Tug Lagga
Tug Lagga
Scale 1:1,370,000
Wyndlawn Caves
R. Ganana
Flows into R. Gillett
Mt. Elwak
Water in pools
One inch = 22 miles
Walker & Boutall sc.

We passed very many deserted villages, however, even close to Sheikh Husein. It was a very rough mountainous path that led from Luku to Sheikh Husein, and my poor camels suffered severely. There is scarcely a camel to be seen in these highlands, as they are not good pack-animals for rough roads, donkeys being used for this purpose.

We reached Sheikh Husein on September 21, and here my caravan was destined to remain for a very long time. I was much surprised at the stone buildings I saw here. There were five shining white tombs of sheikhs, two stone mosques, and many dilapidated stone buildings scattered over the hill. The hill on which the village is situated is 3 miles in diameter at its base, is only 300 feet above the surrounding country, and has a flat top, on which the village is built. Only 6 miles to the south is a splendid group of mountains, from 6000 to 8000 feet high, to the highest one of which the name of Gubeion is given. To the left is a most striking mountain, somewhat isolated from the rest. This is Abugassim, and is a great landmark. Very near to Sheikh Husein, the river which forms the principal source of the Webi Shebeli, and which I shall call after myself, winds south as it passes in front of Mount Abougassim. It flows north-east, and finally south-east into the Shebeli river. I found another stream emptying into the Shebeli just below this, which I traced to its source. It is called the Darde, and never dries up, according to native report. It rises, as do most of the streams in this part of Africa, from the mountains surrounding this great grassy plateau called the Budda, the eastern end of which I reached as shown on my map.

I had a good opportunity to make a thorough survey of this country, and to do a great deal of collecting. The woods were full of beautiful birds and butterflies and flowering plants. The thermometer at Sheikh Husein averaged 73°, while on the highest plateaus it averaged 62° for twenty-four hours. My Somali boys suffered severely from the cold and the rain, which fell in torrents for a short time every day or night.

I will cut my story short, merely stating that the Abyssinians would not let me advance. They twice stopped us with an army at Emperor Menelek's order, and I have been compelled to return to the Webi Shebeli. Mr. Gillett and I made a rich discovery in the way of a subterranean passage. A large tributary of the Jub river had carved its way through a hill for one mile, as it curved south-east through a deep canyon. This stream is called the "Web," and the river Smith is called the "Wabi" by the natives; but the names are often confused, so I have named the "Web" river Gillett, and the caves I have marked on my map as the caves of Wyndlawn.

On the north side we could only penetrate a little over 100 yards, as the hill had fallen in on one side of the stream. The stream was too deep for us to cross, but I could see high chambers continuing

indefinitely into the darkness on the other side. On the south side we went a long way into the heart of the mountain, the vaulted roofs overhead being over 30 feet high.

Not far from these caves is a splendid rugged mountain range called the Darro and Howattu mountains. The country between these and the Webi Shebeli is very broken and rough. On my journey north this had appeared to be a very evenly inclined plain, rising gradually towards the west. In traversing this on my return to the Webi Shebeli, I found it to be cut up into broad valleys not over 500 feet deep. The hills are flat-topped and of a uniform height, giving the appearance to the country of its having been broken up by glacial action, the course of the valleys taking in general a south-easterly direction. Deep rifts and many dry beds of streams, as well as great heaps of loose stones, make rapid travelling an impossibility. The soil is a very light clay, and contains much salt. In two of these tugs we found water in pools, and a tiny variety of perch, which shows the water does not dry up. I am quite satisfied that there is a far greater rainfall as one progresses north-west from Somaliland.

We are all very well, although much disappointed at having to retrace our steps. However, I have no doubt that, by crossing the Webi Shebeli far south, and making a hard push, we shall avoid the Abyssinians until we get among the Borans, who are their enemies still. They would have to deal with an unconquered people before they reached us in this case. Emperor Mênelek claims the whole country as far south as the sea!

I enclose a map of the country as far as I have gone. Mr. Gillett, Dodson, and I are in excellent health. I have no doubt that we shall finally reach Lake Rudolf, although it will take a long time to do so. I am obliged to make long, tedious stops to allow the camels to pick up, as they suffered much in the mountains.

THE DEVELOPMENT OF CERTAIN ENGLISH RIVERS.

By WILLIAM MORRIS DAVIS, Professor of Physical Geography, Harvard University.

Thesis.—The rivers of Eastern England have been developed in their present courses by the spontaneous growth of drainage lines on an original gently inclined plain, composed of sedimentary strata of varying resistance. In the course of this development, the land has been at least once worn down to a lowland of faint relief, and afterwards broadly uplifted, thus opening a second cycle of denudation, and reviving the rivers to new activities; and in the second cycle of denudation, the adjustment of streams to structures has been carried to a higher degree of perfection than it could have reached in the first cycle.

Outline.—1. Introduction. 2. Division of region. 3. Statement of the case. 4. General geological history of region. 5. Deductive scheme of river development.

6. The growth of subsequent streams. 7. Diagrams of river adjustments. 8. Conditions determining river adjustments. 9. Consequences of uplift of land-area. 10. Necessity of explicit statement of theory. 11. Evidence of uplift of land-area. 12. Marine or subaërial denudation. 13. Criteria for discrimination. 14. Subordinate conditions. 15. Consequences of theory confronted by facts. 16. The rivers of Eastern England. 17. Conclusion.

1. After much study of English maps and writings at home, I have been tempted to entertain certain theories regarding the development of English rivers, and to announce them in recent years to my college classes; but realizing the danger of theorizing at a distance, a part of the last summer has been given to an excursion over the ground, so as to test the theories by examination of the country and by conference with English students of the question. The experience has been most enjoyable, and in the hope of securing comment and discussion on a subject of so much interest in physical geography, the following statement of the problem and its results is submitted to those who may examine the question more deliberately.

2. Broadly speaking, England may be divided by the irregular lowland belt of New Red Sandstone into a region of older structures and more complicated forms on the west, and a region of younger structure and more simple forms on the east. The western region has three centres with various dependencies, all worthy of finer subdivision: the Lake District, with the great stretch of Carboniferous beds from Northumberland to Derbyshire; Wales, with the small isolated midland Carboniferous districts; and Cornwall. The eastern region, characterized by the escarpments of the Oölite and Chalk, with their uplands and dip slopes and Tertiary margins, is divided by the transverse depressions of the Humber and the Wash north of the London basin, and somewhat complicated by the uplift of the Weald in the south-east.

3. The rivers of the newer eastern region, and of the intermediate lowland, as well as some of the streams of the older western region, present certain geographical features of systematic arrangement that seem capable of explanation, because their arrangement falls into so close accord with the expectations concerning river growth that are deducible from the geological history of the region. In short, the rivers of to-day, in the mature stage of the present cycle of denudation, appear to be the revived and matured successors of a well-adjusted system of consequent and subsequent drainage inherited from an earlier and far-advanced cycle of denudation. Perhaps the best way of explaining what is meant by this condensed statement will be first to follow through an ideal but reasonable and pertinent system of river development, and afterwards to match its deductions with the facts presented by the existing rivers.

4. Imagine a well-varied mountainous region gradually wasting away by denudation, and as gradually sinking beneath the sea. Its windward

slopes will be well washed by sufficient rains; its leeward slopes will be drier, and, if the height of the mountains is great enough, the lowlands at the leeward base may possess saline lakes, around and within which the waste from the mountains will be deposited, with the remains of land animals and plants, or with forms representing fresh or brackish water. As the depression of the region continues, the mountains lose their former height both by wearing down and by sinking; the Piedmont lowlands may be submerged, and marine sediments will then bury the subaërial and lacustrine deposits, and encroach upon the fading mountains. The ridges will stand out as capes and promontories; the valleys will be drowned into estuaries or fiords; the streams will be shortened by the submergence of their lower courses, and often enough what was at first a single river-tree with many branches is now converted into several smaller independent rivers by the loss of the trunk stream in the drowned valley. Having frequently to speak of such dissevered rivers, which are very common in many parts of the world, I have fallen into the habit of calling them "betrunked;" the term being analogous to "beheaded," the two terms serving very well to suggest the opposite processes by which rivers are often affected.

The strata deposited during the submergence of the region will diminish in thickness off shore, and an increasing proportion of calcareous material may be expected as the neighbouring land-area decreases. The once lofty mountain summits, now worn down to a tolerably accordant height as the sea rises, may finally be quite submerged. Although the mountain range may have been denuded by thousands of feet during this long chapter of earth-history, and although the sediments furnished by so great a denudation may have accumulated to a thickness of thousands of feet in the encroaching sea, yet the littoral sea may not have been at most more than a hundred fathoms deep during the whole process; deposition may have so nearly balanced depression that shallow water was maintained during the whole period. Indeed, by introducing such episodes as halts in the depression, or even slight movements of elevation; by admitting climatic variations from dry to wet, from warm to cool, all manner of natural complications may be introduced in the series of strata by which the old mountains are finally buried.

5. Now reverse the process. Let gradual and intermittent elevation replace depression. Let the greater elevation be in the region of the old mountains. As the sea-bottom rises to form a new land, it will take the shape of a gently sloping plain. Streams will gather, guided by the slight inequalities of the constructional surface, and run down its faint incline to the sea, their length increasing as the shore recedes. If the uplift is uneven, with domes and troughs, the streams will assume an appropriate arrangement, in accordance with the special directions of the dip slopes. If certain residual summits of the old mountains were not completely drowned and buried at the time of greatest depression, the

short betrunked streams that ran from them will be the initial head-waters of the new drainage system on the rising coastal plain; but many entirely new streams will be formed on intermediate parts of the plain. The latter may be called simple consequent streams. The former will be old streams in their upper courses, surviving on the mountain heads from the former cycle of history, and now extended by the mouthward addition of consequent lower courses. Various independent old betrunked head-waters may in this way be engrafted on a single new consequent trunk stream. In describing existing river systems, it is certainly desirable to bear in mind the changes of this kind that the past may have played in bringing forth the present. The term "consequent" was introduced by Powell; "extended" has been used by Tarr in the sense here adopted.

Let there now be conceived a pause in the process of elevation after the uplift has reached a measure of 2000 or 3000 feet, and after the growing plain has attained a breadth of 100 or 200 miles. The consequent streams proceed to entrench themselves in the slanting plain, and in a geologically brief period, while they are yet young, they will cut their valleys down so close to baselevel that they cannot for the time being cut them any deeper; that is, the streams will, of their own accord, reduce their valley lines to such a grade that their capacity to do work shall be just equal to the work they have to do. When this condition is reached, the streams may be described as having attained a "profile of equilibrium;" or, more briefly, they may be said to be *graded*. It may be noted, in passing, that inasmuch as the work that a stream has to do is constantly varying, it must as constantly seek to assume new adjustments of grade. In the normal course of river events, undisturbed by outside interference, the change in the work is so slow that the desired adjustment of capacity to work is continually maintained. It may be that during the adolescence of river life, the work to be done is on the increase, on account of the increasingly rapid delivery of land-waste from the slopes of the growing valley branches; and in this case, part of the increase of waste must be laid down in the valley trough so as to steepen the grade, and thus enable the stream to gain capacity to carry the rest. Such a stream may be said to aggrade its valley, adopting a good term suggested by Salisbury; and in this way certain flood-plains (but by no means all flood plains) may have originated. Aggrading of the valley line may often characterize the adolescence of a river's life; but later on, through maturity and old age, the work to be done decreases, and degrading is begun again, this time not to be interrupted. The longer the river works, the fainter is the grade that it adopts.

6. While the original consequent streams are thus at work cutting down, aggrading, and degrading their valley lines, lateral branches will be developed by headward erosion in greater or less number. In regions of tilted structure, with alternations of distinctly harder and softer

strata, the lateral branches will be developed along the strike of the softer masses; and inasmuch as such streams can be developed only after opportunity is offered to them by the deepening of the original consequent valleys, it seems appropriate to call them subsequent streams; the term "subsequent" having been used by Jukes in his important essay on certain valleys in the south of Ireland (*Quart. Jour. Geol. Soc.*, xviii., 1862), essentially in the meaning here given, although not as a technical term. The peculiarity of subsequent streams is, therefore, that they run along the strike of weak strata; while consequent streams run down the dip, crossing harder and softer strata alike. The stronger the dip, and the more marked the contrasts of harder and softer strata, the better the definition of the subsequent streams. Professor Green clearly recognizes streams of this kind, and gives examples and illustrations of them in his 'Geology' (pp. 425, 426), but he conceives them as beginning on a plain of marine denudation, not on the side of a consequent valley in an original constructional land surface. He calls them "longitudinal," thus not separating them from many longitudinal consequent streams, such as are found in the synclinal troughs of the Jura, or of which the Kennett-Thames may be taken as an example. He does not mention their relation to adjustments, considered below, and he seems to regard them as of exceptional or peculiar occurrence, for he refers to the subsequent streams of southern Ireland as "erratic" (p. 428), and calls the longitudinal and transverse drainage systems of the Oxford and the Weald districts "anomalous" (p. 429). It seems to me, on the contrary, that the drainage of these districts is singularly normal and systematic, as will be further shown below. Ramsay, Greenwood, Foster, Topley, Whitaker, and others, also explain examples of subsequent streams in various localities, but I believe in all cases they assume that a beginning was made on a plain of marine erosion, and the generality of the process by which subsequent streams are developed is hardly recognized.

In the case of the new coastal plain, imagined above, let it be supposed that the dip of the uplifted strata and the variations in their resistance is sufficient to give a fairly distinct guidance to the growth of subsequent branches of the consequent streams. A most interesting result follows from this supposition. The larger consequent streams will deepen their channels more quickly and to a lower grade than the smaller consequent streams. The lateral subsequent branches of the larger consequent streams will grow headward along the strike of the guiding weak strata more rapidly than the corresponding branches of the smaller consequent streams, and as a result the upper courses of the smaller consequent streams will be abstracted or diverted by the victorious subsequent streams, leaving the lower courses beheaded. Thus of all the original consequent streams, the smaller ones are naturally selected to be broken into two parts: an upper part, which is diverted

by a subsequent stream into a larger consequent stream; and a lower part, which pursues its way alone to the sea. In this there arises a mature adjustment of streams to structures that is of great significance in river history.

7. Figs. 1 and 2 will, perhaps, make the scheme of adjustment more apparent. The straight consequent streams, *a* to *i* (Fig. 1), follow the direct courses suggested by the constructional surface, and flow immediately to the constructional shore-line. They differ in volume, *e* being the largest, and *h* the next, while *f* is the smallest. All of them go to work at once, cutting down their channels to the grade adapted to their volume and their load, and sending out subsequent branches wherever the faster wasting of softer strata on the valley slopes may determine,

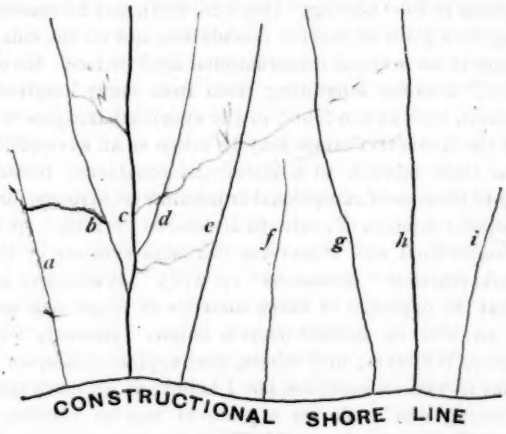


FIG. 1.

and at the same time the slowly retreating edges of the more resistent strata take the form of inland-facing escarpments, of which more is said below. Stream *a* is tapped in its upper course by *m'*, a subsequent branch of *b*; the upper part of *a* is then diverted to swell the volume of *b*, while the lower beheaded part of *a* is reduced correspondingly. A pretty consequence of this change may sometimes be seen in the obstruction of the beheaded stream by the waste brought down by rivulets on its valley slopes; such being essentially the case of the lakes of the Engadine, at the head of the river Inn, as described by Heim. Moreover, for a short time after the capture is made, the diverted and diverting streams will flow in a local gorge, just above and below the "elbow of capture," as might be illustrated by special examples. In the same way, the upper part of *b* is tapped by *n'*; *e* is divided into three parts, being tapped by *m''* and *n''*. It is manifest, that of the three captures

made by n'', the first was d, and the last was g. At a still later time, even the head of h may be diverted by the further extension of n''. The mature arrangement of the streams, therefore, differs systematically from their arrangement when only their initial consequent courses existed, and any region which offers an example of so specialized a drainage system may be accepted as one of the most trustworthy witnesses to the theory of the uniformity of geological processes. No cataclysmic struggles could account for so particular a relation between internal structure and superficial drainage, as must necessarily result from the patient processes of inorganic natural selection here outlined.

Mr. Jukes-Brown has, of all English writers known to me, made the most explicit reference to the spontaneous rearrangement of river courses by the process here described ("On the Relative Ages of Certain River Valleys in Lincolnshire," *Quart. Jour. Geol. Soc.*, 1883, pp. 596–610); but he, like the other writers already referred to, assumes a plain of marine denudation as the beginning of the river history. His recognition of the general applicability of adjustments to explain river courses will appear from the following extract: "I believe that the principles above enunciated and exemplified will explain the courses of certain other English rivers, and purpose recurring to the subject in a future paper" (p. 610). So far as I know, the future paper here referred to has not yet been prepared.

Mr. Cadell has described certain valleys in the southern part of the Highlands of Scotland as rearranged by the spontaneous action of the streams themselves (*Scot. Geog. Mag.*, ii., 1886, pp. 337–347); but he ascribes the changes to the action of the rivers from up-stream downwards, and this does not seem admissible. All such changes are caused, not by the downward action of the stream that is to be diverted, but by the headward or backward action of some other stream, which for some reason has an advantage over the first. The change is always passive so far as the changed stream is concerned. Messrs. Foster and Topley at a much earlier date approached the subject of adjustments in their essay "On the Superficial Deposits of the Valley of the Medway" (*Quart. Jour. Geol. Soc.*, 1865, pp. 443–474), but the systematic relations of the various parts of an adjusted drainage system were not then fully worked out. It is chiefly from the writings of Gilbert, Heim, Löwl, and Philippson that I have gained the ideas here presented.

8. The degree of adjustment of mature streams varies with many determining conditions. Those which favour a high degree of adjustment are: 1. Considerable diversity in the size of the initial consequent streams; the old-land streams that are extended across the new coastal plain by the addition of consequent lower courses generally having an advantage on this account. 2. Considerable altitude of the land-mass exposed to erosion, thus allowing the larger consequent streams to cut valleys of a significantly greater depth during their adolescence than is

allowed to the smaller consequent streams. 3. Considerable diversity of resistance in the strata that are cut through by the streams; a very resistant stratum serving to increase the contrast of depth in the adolescent valleys of the larger and smaller streams, and a very weak stratum beneath the resistant stratum serving to guide the rapid headward growth of subsequent branch streams. 4. A significant amount of inclination in the strata, so as to give distinct guidance to the growth of the subsequent branches. When all these variable elements conspire to favour an adjustment of streams to structures, the systematic arrangement of land features becomes very striking during the mature stage of river life. The denuded and retreating margin of each resistant stratum takes the form of an inland facing escarpment: its dip-slope towards the shore is more or less stripped of any weaker strata that may have

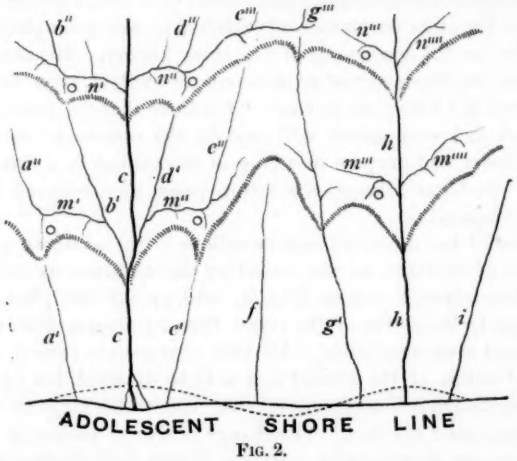


FIG. 2.

originally covered it; its escarpment face sheds short, back-flowing streams into the longitudinal subsequent valley that has been developed along the weak underlying stratum: and, even at the risk of multiplying terms unduly, I would suggest that these streams be called *obsequent*,* as their direction is opposed to that of the initial consequent streams. Several of them are indicated by the letter *o* in Fig. 2. In cases of recent capture, obsequent streams are wanting, as at the elbow where *g'''* turns into *n''*; in cases of more remote capture, the obsequent streams acquire all the drainage on the inland slope of the retreating escarpment. The crest of the escarpment turns inland and reaches greater height about midway between the consequent streams, but curves seaward and

* In earlier writings, I have used the term "inverted" for streams of this kind; but, as its meaning is equivocal, it should be abandoned.

loses height on approaching the transverse valleys that are kept open by the successful consequent streams. The notches in the escarpment, cut by unsuccessful consequent streams before their upper part was diverted, are of varying depth; generally being least perceptible nearest the largest successful or persistent consequent streams, for here the diversion was early accomplished, and most perceptible farthest from the persistent streams, for there the diversion was longest delayed and the notch was cut deepest before it was abandoned.

When the uplifted coastal plain contains more than one resistant stratum, there will be a corresponding increase in the number of inland facing escarpments, of longitudinal subsequent streams, and of adjustments, until a most beautiful complication is attained. The arrangement of the various parts will be remarkably systematic, hence when an explorer sees what seems to be any one of these parts, he should always look for its associated fellows, and in accordance with the perfection of their display he may easily and briefly describe the geographical features of the region that he traverses.

The best examples of the adjustment of streams to structures will be found in and shortly after that stage of the development of a region when its relief is strongest and most varied; that is, during maturity and advancing older age. But as time passes on, and even the harder rocks are worn down lower and lower, the streams meander somewhat freely from side to side, and depart to a greater or less degree from the close adjustments of maturity; yet we may seldom expect to find a region worn down so low in its extreme old age, that the streams shall have lost all traces of the adjustments that they must have once possessed. It is truly possible to imagine a plain of denudation so well completed that it has lost all perceptible relief; but in actual geographical experience, no such plains are discovered. Some residual relief occurs in all known examples of this kind, and, in order to emphasize this general truth, it seems to me advisable to call such almost-denuded surfaces, *peneplains*. The river systems of peneplains are in the condition of fading adjustment. A significant peculiarity of relief in a peneplain produced by the far-advanced denudation of a coastal region such as has been described above, is found in the increasing straightness of its fading escarpments.

9. Now, if it is not too fatiguing to pursue deductive considerations still further, let a second cycle of erosion be introduced by a new uplift of the peneplain that was produced in the first cycle. Thereupon a new strip of coastal plain will be added on the seaward margin of the peneplain; the old rivers of the first cycle will be extended across the new plain to the new shore; and (unless the slope of the new plain is less than the grade of the extended rivers, which is very unlikely) all the old rivers will be revived into new activity. From wandering idly on the old low peneplain, they will at once proceed to incise the newly uplifted peneplain. But in two significant respects, the features of the second cycle

differ from those of the first. In the first place, at the beginning of the initial cycle there were no subsequent streams; all the drainage was consequent. At the beginning of the second cycle, a considerable share of the drainage may be along revived subsequent streams; and with this opportunity so early afforded, the adjustments of the second cycle may exceed those of the first. Consequently, the adjustments in the maturity of a second cycle, following the older age of a first cycle, may reach a high degree of perfection. In the second place, the crest-lines of the escarpments or ridges in the second cycle will for some time retain the evenly bevelled form to which they were reduced at the close of the first cycle. When a region presents these two special features together, it can hardly be doubted that two cycles of subaërial denudation have been more or less completely passed through in its geographical development. A type of such an example of composite topography, that is, of a region whose features are referable to the work of two geographical cycles, is given in Fig. 3. The added strip of new coastal plain lies between the old and the new shore-lines. In their extension across it, the streams *c* and *e*, *g* and *h*, are engrafted in pairs. The escarpments, having been reduced to faint linear mounds at the close of the first cycle, now run straight along the strike of the controlling strata. The larger streams in particular possess strongly meandering courses, whereby they have departed more or less from their original lines. The subsequent streams have been much advanced, partly in the first cycle, partly in the second cycle; and they have shifted their courses a little down the dip of the weak strata that they follow. The identification of the several parts, as *e'*, *e''*, *e'''*, of a once continuous consequent stream becomes difficult and doubtful. The importance of the obsequent streams has somewhat increased. Supposing stream *h* to have been doubly beheaded by *m''* and *n''* in the second cycle, and therefore at a date after it had learned to meander in large curves, its lower course, *h'*, will now be found "wriggling" in diminished volume along the large curves that it once followed smoothly. The stream *c*, the master of the region, with increasing volume from its successive captures, will fill its curves well, and will even extend their radius as it cuts down to a new grade in the second cycle.

10. Although this is an overlong introduction to the remainder of the article, it is absolutely essential to the appreciation of the points that I desire to make; for unless the expectations and consequences of a reasonable theory are well worked out, there are no definite mental conceptions to be confronted by the facts. The deductions must be made as carefully as the inductions, the two classes of knowledge being held carefully apart until their comparison is undertaken. Then just in accordance with the degree to which the deductions and inductions match one another will confidence be allowed or compelled in the theory by which the deductions were reached. As a matter of practical

experience, it is seldom that every deduction will find its mate among the inductions, and *vice versâ*. There will nearly always be some fact of observation not accounted for by theory; some expectation of theory not discovered among the facts; and no part of careful investigation is more exhilarating than the search thus excited in quest of the missing mates. Finally, when the pairing off is essentially complete, conviction grows spontaneously, and the will has little to do with the belief.

The theory here outlined seems reasonable, because it appeals to no extraordinary processes, and because every one of its requirements in the earlier or later stages of its advance may be compared with the facts of some actual district, where the inferred conditions really exist. The once lofty mountains in Wales and northward, near whose leeward base there were interior saline lakes, may be compared with the now lofty mountains of California and Oregon, which withhold the rainfall from the arid plains to the east; indeed, under no other conditions can a dry climate be produced near the eastern side of a great ocean and in so high a latitude as 50°. The relation of simple and extended consequent streams on a new coastal plain may be well studied in the rivers of North Carolina. The progressive development of escarpments and of adjusted rivers can be followed in various stages on different parts of the coastal plain of our Atlantic and Gulf states; or again in north-eastern France, where the interaction of certain rivers is most beautifully shown in the neighbourhood of Châlons-sur-Marne. The even crest-lines of ridges and escarpments in the maturity of a second cycle following the old age of a first, are wonderfully displayed in the Appalachians of Pennsylvania, where the adjustment of the rivers to the structures is also most admirable. The processes of river development are not newly invented, but are such as have been worked out by Jukes, Heim, Löwl, Philipson, and others in Europe; by Powell, Gilbert, and others in America.

The theory is pertinent to the case in hand—the development of the newer rivers of England—for all manner of facts point to the former higher stand and greater mass of the mountains in the west; to their gradual submergence and burial in sheets of sediments that become thinner eastward (see "Areas of Apparent Upheaval," by W. Topley, *Quart. Jour. Geol. Soc.*, 1874, pp. 186–195), and more calcareous upward; then to the emergence of the sea-bottom, forming a new coastal plain, down whose slopes numerous consequent rivers took their way; to the special case of the consequent streams on the dome of the Weald; to the development of subsequent streams along the weaker strata, and the advance of river adjustments thereby; to the upheaval of the land after much work had been done in an earlier cycle, thus reviving the rivers for a continuation of their first-cycle work in a second cycle. Much of this is simply the standard material of English geology, and I need, therefore, call attention to only a few of these headings.

11. Let us consider first the evidence that may be found indicating that at least two cycles of subaërial denudation have been involved in the development of the geographical features of eastern England, the first cycle having reached old age, the second cycle being at present in its maturity. Look at the remarkable evenness of the Oölite and the Chalk uplands in Yorkshire, Lincolnshire, Oxfordshire, Surrey, and Kent. Ramsay repeatedly refers to these districts as "a tableland," "a second plain," "an upper plain," "flat-topped escarpments," in his 'Physical Geology and Geography of Great Britain.' Remember that the most reasonable view concerning the original extension of the strata of these uplands would carry them high in the air over the midland Triassic lowland and over the denuded area of the Weald, and then ask how the processes of denudation could reduce the original constructional extension of these strata to the even uplands in which they now terminate, the uplands being distinctly above the present baselevel of erosion. This question has evidently been considered; but the answer that I find current in the literature of the subject, as well as in the minds of several English geologists with whom I have lately discussed the question, is not altogether satisfactory. There is truly a general disposition to recognize the Oölite and the Chalk uplands as remnants of a once widely extended surface of denudation, but the agency by which the denudation was accomplished is thought to have been the sea; the uplands are regarded as the remnants of an uplifted plain of marine denudation, not of an uplifted peneplain of subaërial denudation.

12. It should not in this day require much argument to convince one of the abstract possibility of producing relatively even lowlands or peneplains either by marine or by subaërial denudation. Whatever the constructional mass may have been on which the destructive processes work, either process would slowly reduce it to an almost featureless peneplain, if time enough were allowed. Forty years ago, it was natural that marine erosion should have the greater number of advocates, as atmospheric denudation was not then fairly recognized. Now, although the efficacy of rain and rivers to produce cañons, valleys, and escarpments is generally admitted, there is still, strangely enough, a prevailing indisposition to follow the process to its legitimate conclusion, and recognize peneplains as well as valleys among its possible creations. This hesitation seems to me unreasonable. There should be no question of the ability of atmospheric denudation to produce peneplains; but there may, of course, remain a large question in trying to decide whether a given peneplain is the product of atmospheric or of marine attack.

It should be noted that, unlike many later writers, Ramsay explicitly included atmospheric processes in the production of what he called, for brevity, a plain of marine denudation. He refers to the open lowlands

of the weak Trias and Lias areas in central England as broad plains, recognizing them as widened valleys. Mackintosh, on the other hand, in his 'Scenery of England and Wales,' may be taken as representing the extreme marine view; even interior lowlands, like those just referred to, being, in his opinion, of marine origin. Professor Green, on the other hand, states clearly the abstract possibility of subaërial denudation reducing highlands to lowlands; but he does not enforce the principle by examples. Sir Archibald Geikie describes the dissected plateau of the Scotch Highlands as the remnant of an uplifted plain of marine denudation in the first edition of his 'Scenery of Scotland;' but in the second edition he seems to give preference to subaërial denudation.* The important point, however, would seem now to be the invention of criteria by which plains of truly marine denudation may be distinguished from those that have been exposed only to the attack of the atmosphere.

13. The solution of this question can only be reached by special studies of each case, when its particular features must be examined to see if they bear the marks of one process or of the other. The uplands of the Oölite and the Chalk seem to me to be remnants of a peneplain of subaërial denudation, for the reason that their drainage is accomplished in great part by subsequent streams (more fully stated below), as should be the case if the present streams are the revived successors of those of a former cyle of atmospheric denudation; and not by superposed streams

* A note may be introduced here in order to call attention to one conclusion in that admirable book which does not seem compulsory. Although perhaps not absolutely stated, it is clearly implied that it was Devonian erosion by which the once low and comparatively even surface of the now uplifted and dissected Highlands was produced. It is plainly manifest that Devonian erosion consumed a great volume of the contorted and overthrust rocks of the Highlands: witness the great volume of the Devonian strata lying unconformably on the Highland rocks, and the identity of the Devonian conglomerate pebbles with the rocks of the older terranes. It may indeed be well argued, from Sir A. Geikie's essay, "On the Old Red Sandstone of Western Europe" (*Trans. Roy. Soc. Edin.*, xxviii., 1879, pp. 345–452), that a vast denudation was accomplished in earlier times than Old Red, and that by the close of the Old Red period the Highland region must have been truly a diminished lowland, a peneplain, of small area and moderate relief. But, on the other hand, the Old Red sandstones, in certain parts of the Highland region at least, have been much disturbed, tilted, and faulted; and it is in the highest degree probable that the ancient peneplain produced by Old Red denudation, marine, subaërial, or both, has also been disturbed, tilted, and faulted since Old Red times: and hence that the once roughly evened upland, in which the greater number of the present glens have been eroded, was produced at some time *after* the deformation that disturbed the Old Red formation. The date of this later denudation is at present indeterminate, but the altitude attained by some of the Tertiary dikes in the Highlands would indicate that not only the glens were of later origin than the dikes, but that even some of the finishing touches in the production of the rough-cut old Lowland—now Highland—were of later date than the volcanic period of that magnificent region. Indeed, it seems very doubtful if anywhere in the world, even in regions of the most resistant rocks, even a trace of a Devonian land surface, from then till now exposed to erosion, could be preserved.

imperfectly adjusted to the structures, as should be the case if the region had been denuded by marine action, and then elevated to its present altitude above sea-level. This distinction deserves a brief digression.

The original conception of a plain of marine denudation as presented by Ramsay fifty years ago, and as still commonly accepted, involves the idea of a gradual sinking of a land-mass, while the forces of the atmosphere are wasting its surface and the waves of the sea are eating into its margin. If the sinking be slow compared to the in-cutting of the waves, the land will be cut down to a comparatively level platform; any rivers that existed on the land surface will be extinguished, and the greater part of the platform will be strewn over with the waste from the shore. When elevation sets in, the platform will rise with the cover of marine sediments on its back; an entirely new system of drainage will be developed, consequent on the constructional slopes of the new land-area, and although the streams thus originated may in time cut through the cover of marine strata into the under-mass, although the marine cover may be quite stripped off so that not a remnant of it remains, although the streams may become somewhat adjusted to the structure of the under-mass as their valleys are cut down into it,—yet it seems impossible that the adjustments thus gained in a single cycle should be nearly so perfect as those that *must* obtain in consequence of two cycles of subaërial denudation. It must be carefully borne in mind that the hypothesis of marine denudation requires the extinction of all previous drainage systems and the inception of a new system of streams, consequent upon the slopes of the "cover," but entirely independent of the structure buried beneath the cover; while the hypothesis of subaerial denudation as distinctly requires the retention of a previously maturely adjusted drainage system, excepting for a partial loss of adjustment caused by the wandering of the streams in their old age. It must be remembered that the hypothesis of marine denudation demands the beginning of the present cycle of denudation without any subsequent streams; while the hypothesis of subaërial denudation equally demands the existence of a considerable number of subsequent streams at the time of upheaval. All things considered, a region with uplands so even and with so many subsequent streams as eastern England possesses should, I think, be regarded as now standing in its second cycle of subaërial denudation, and not in a first cycle of subaërial denudation, following a former cycle of marine denudation.

14. There are certain rigidities of conception that must be guarded against in considering this problem. It need not be supposed that the former cycle of denudation reduced the region to a dead level. Most of the peneplains that I have examined, even though now uplifted and somewhat advanced in the dissections of a second cycle, still possess residual elevations, rising somewhat above the general upland, and evidently to be regarded as unconsumed remnants of the denudation

of the former cycle. From the need of reducing such matters as these to some simple form of statement for use in teaching, I have fallen into the habit of calling a residual mound of this character, a *monadnock*, taking the name from that of a fine conical mountain of south-western New Hampshire, which grandly overtops the dissected peneplain of New England. Of course there may be little monadnocks or great ones, they may be few or many, but in my views of the wolds and the downs I saw none of them; the peneplain in which the valleys of old England are etched seems to have been a very smooth one. Again, it must not be assumed that the once nearly level surface of the peneplain was lifted up with perfect equality of elevation. Not only was there probably a greater elevation in the west than in the east; there may have been also widespread or local warpings, some of which may have been strong enough to affect the courses of the old streams at the time of their revival into the present cycle. This must be discovered by a careful determination of the height at which various parts of the still preserved peneplain now stand, in the manner adopted by Messrs. Hayes and Campbell, in their recent study of the southern Appalachian mountains (*National Geog. Mag.*, Washington, 1894); and I shall hope to see this problem undertaken by some English student of physical geography, who has the country, the maps, and the literature of the subject close at hand. Finally, it must not be supposed that the movements of elevation here referred to are the only ones that have to be considered; they appear to be the chief ones, but the effects of other movements, as well as of glacial episodes, must be carefully examined when the subject is minutely studied, instead of broadly sketched.

15. We may next consider how far the expectations of theory concerning the arrangement of river courses, summarized in Fig. 3, are confirmed by the actual arrangement of river courses in eastern England. This may be best done by attempting to classify the existing rivers as consequent, subsequent, and obsequent; noting at the same time the relation that the consequent streams have to the process of capture or diversion by the appropriate subsequent streams, as indicating the degree of perfection to which the adjustment of streams to structures has advanced. The subsequent streams must, of course, occur only along the strike of relatively weak rocks; the obsequent streams run against the dip of the strata, down the face of escarpments of greater or less strength; the consequent streams run with the dip of the strata, still possessing a considerable length if not broken by the subsequent branches of larger consequent streams, but often reduced to moderate dimensions when repeatedly beheaded by diversion and adjustment.

16. Beginning in the north, we find the Tees and the Swale-Ouse to be subsequent streams on the New Red lowland, each of them serving as diverters of various consequent streams that come down from the Carboniferous uplands on the west, and each receiving various "becks"

from the Oölite escarpment on the east. The success of the Tees in gathering consequent head-waters from inland is lessened by the interposition of the magnesian limestone escarpment, back of which the Wear carries away a number of head-waters from Bishop Auckland northward. The Swale-Ouse does better: the Swale, Ure, Nidd, Aire and Calder, Dearne and Don are all turned along the open subsequent valley of the Swale-Ouse, unable to maintain the straight consequent courses that they may be inferred to have had initially across the Oölite and the Chalk; the Aire and Calder, the Dearne and Don, joining forces in pairs behind

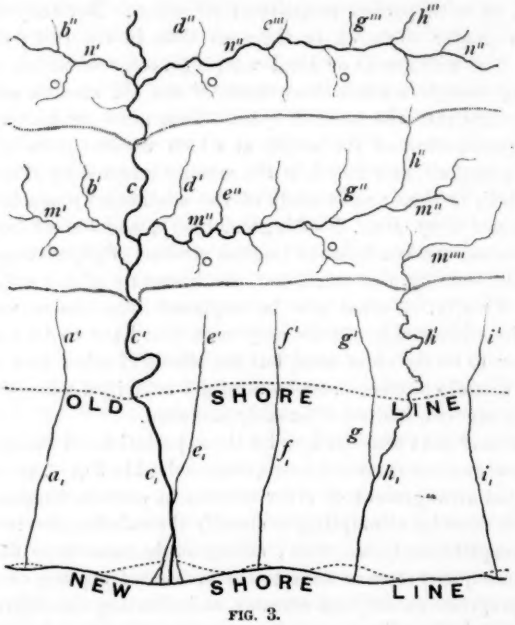


FIG. 3.

the magnesian limestone. Representatives of the middle parts of some of these original consequent rivers should be found among the diverted consequent branches of the subsequent Yorkshire Derwent, such as the Rye, Riccal, Dove, and Severn rivers, and the Costa, Pickering, and Thornton becks. Still lower parts of the original consequent rivers of the region should be looked for on the back or eastern slope of the York wolds from Great Driffield to Hull. The subsequent valleys of the Tees and the Swale-Ouse on the New Red, and of the Derwent on the weak Upper Oölite, receive appropriate obsequent branches in many small streams and becks from the faces of the adjacent escarpments. The water-parting, or "divide," between the subsequent courses of the Tees and

the Swale should be carefully studied; for at such a point of competitive capture, a slight change in the altitude of the land, as by an elevation or depression on the north or south, will give one stream an advantage over the other, and thus cause a shifting of the neighbouring consequent head-water stream from one system to the other. The peculiar position of the head of the subsequent Derwent, close to the sea, suggests some glacial interference with normal adjustments, and calls for special explanation.

The Humber, enlarged by drowning and by resultant tidal action in its lower course, should be looked upon as the main consequent trunk stream of the region, its upper course having been perhaps somewhere about Halifax or Huddersfield; but its present importance is due to the great success of its chief subsequent branches, the Ouse, the Idle, and the Trent. There should, however, be some reason for the successful growth of the Humber at the expense of its early rivals. It may have been originally the largest consequent stream of the region, or the thinning of the Oölites on its lower course may have given it an early advantage (though in this case it ought to lie a little further north).

Like the Yorkshire Ouse, the Idle and the Trent gather a number of consequent head-waters from the high ground of the Carboniferous on the west, many of these being more or less divided by subsequent streams on the softer strata of the region which they drain. The course of the Trent at Nottingham is certainly a fine case of adjustment to the weak sandstones, and of avoidance of the harder Carboniferous rocks on the north and the Lias hills on the south-east. Superposed drainage, settling down into unknown structures through an unconformable cover, such as must have cloaked the region if it had been denuded by marine action, could not be expected accidentally to hit upon so suitable a path. Similarly, the obsequent-subsequent course of the Soar, between the resurrected Carboniferous hills about Ashby-de-la-Zouche, and the retreating Lias upland to the east, should not be ascribed to the chance of superposition. Likewise, the centrifugal drainage of the Carboniferous west of Birmingham, to the Trent on the east, and the Severn on the west, does not imply a haphazard origin of stream courses, but an origin by the patient processes of natural selection. All these cases, taken together, seem to me to call imperatively for an arrangement of stream courses by systematic adjustment.

One of the greatest successes of the Trent was the capture of the upper Witham, as explained by Mr. Jukes-Brown, in an article already referred to. It is interesting to notice that this capture was effected so lately in the present cycles, that the Trent has not yet been, and probably will not be, able to send out an obsequent branch through the Lias belt, and push the head of the Witham back to the Oölite outcrop at Lincoln. The transverse-consequent Witham still retains the longitudinal subsequent Till on the north, and Witham-Brant on the south, with

appropriate obsequent branches; but if the land should be raised a few hundred feet, these head-waters would soon be gained by the Trent; and the divide between the successful and defeated systems would be pushed to the notch in the hard Oölite, which would then be a "wind-gap," instead of a "water-gap," as the Pennsylvanians say. The smaller longitudinal subsequent branches of the Humber, between the uplands of the Chalk and the Oölite, deserve brief mention, as illustrating even in a minute way the important part played by adjusted drainage lines.

Most of the rivers that enter the Wash drain a region of nearly horizontal structure; hence their adjusted courses are not of so distinctly a rectangular pattern, as is illustrated in Fig. 3. Still, their frequent choice of longitudinal courses on the weaker formations indicates that here, as elsewhere, the rivers have been left to themselves to work out their own evolution. The Glen to the north of Stamford, and the Nen to the south, are subsequent streams on the weaker beds of the Oölite; the Welland, Gwash, Chater, and Eye being parts of consequent streams that have been captured by these subsequents; and the obsequent branches of the Soar working against these consequents on the western side of the Lias highlands. The Bedford Ouse is a rather irregular subsequent river on the Upper Oölite, south of the Wash, corresponding to the lower Witham on the north. The Tove is one of its consequent branches. The Stoke, Little Ouse, Lark, Ivel, and Ousel are normally developed obsequents, working against the retreating Chalk escarpment. The Cam is subsequent while on the Upper Greensand, but has an obsequent head, working back by Saffron Walden.

Of all the river contests in England, that by which the Thames system has been shorn of its original importance is the most interesting. Here I must regretfully differ from the suggestion made by Ramsay as to the consequent origin of the Severn in an initial constructional trough of the uplifted Mesozoic formations. There is no sufficient evidence that such a trough ever existed; and there is no need for it, if the Severn, like the Trent and the Yorkshire Ouse, be regarded as a subsequent river. Ramsay does not seem to have considered that possibility, but I believe it has been suggested by Mr. Marr. A subsequent growth seems to me much the more plausible explanation for its course along the weak beds of the New Red and the Lias. It gathers a great drainage from Wales, that used to go to the western branches of the Thames system; the Warwick Avon still farther shortens these branches; while the Trent and the Bedford Ouse carry away the heads of many original northern branches. Only the southern branches of the Thames, draining the northern slope of the dome of the Weald, retain anything like their original extension.

The longitudinal axis of the Thames system, following an eastward-dipping synclinal trough, now heads in the Kennet by Marlborough; it

has probably been shortened by the growth of the obsequent head of the Bristol Avon. Running generally south-eastward into this trough from the slope on its northern side, there should be, if no adjustments had taken place, a number of long consequent streams, heading at least as far westward as the Mesozoic strata stretched, and possibly rising in extended streams from such parts of the Welsh highlands as were not submerged and buried by the Chalk. There is much probability that such streams once existed; but now nearly all of them have been broken into three parts by the growth of subsequent streams along the New Red and the Middle Oölite. Even four or five parts may be recognized in some cases, if the subsequent streams on the Lias and the Upper Oölite are included; but I would not go so far as to imply that the successive parts of any single original consequent stream can now be surely identified. The Thames from Reading to Oxford, with the Cherwell or the Evenlode above Oxford, makes the longest remaining part of an initial consequent stream; and it is interesting to notice that these two upper streams still drain a moderate area of Lias country, beyond the Oölite upland, and between the competing head-waters of the subsequent Warwick Avon on the west, Bedford Ouse on the east, and Trent on the north. This is precisely the region where the longest remaining parts of the initial consequent streams should be expected; and in this region there are no distinct obsequent branches of the Avon or the Ouse, although such obsequents are represented by the Ousel and Ivel farther east, and by the Stour, Isborne, and Chelt farther west. Whether the upper Severn represents the original head-stream of the Cherwell or of the Evenlode is a matter for speculation rather than for demonstration. South-east of the Oölite margin, the upper Ray on the east of Oxford, and the Windrush, Coln, Churn, and Swill on the west, are short medial parts of consequent streams which have lost their heads by the successful growth of the Ouse and the Avon, and which have been diverted from their former lower courses by the two subsequents, the lower Ray on the east of Oxford, and the Isis on the west. The Thame and the Ock make another pair of subsequents, entering the Thames from east and west below Oxford. Crossing now to the Chalk, the Lamborne may be regarded as the beheaded lower part of the Coln or the Churn. Then, going eastward, we find the Ray, Misbourn, Chess, Colne, Gad, Ver, Lea, and Beane, all representing the lower parts of beheaded consequent rivers; and it is very noticeable that the deepest valleys through the Chalk, like that of the Colne past Berkhampstead, and the furthest reaching heads, like that of the Lea, which reaches the Greensand, lie in the region between the heads of the competing subsequent Thame and Ouse. Some of these reduced consequent streams appear to show slight adjustment by short subsequent streams along the outer margin of the London Clay.

South of the longitudinal Thames, the drainage of the Weald dome is

very simple and systematic. On the northern slope, the Stour holds its own; the Medway has taken off the head of the Darent; the Mole has beheaded a stream that used to go through the Merstham notch to Croyden; and either the Mole or the Darent has beheaded a stream that made the notch at Caterham Valley; the Wey has recently taken off the head of the Blackwater, near Aldershot. On the southern slope, the Cuckmare, Ouse, Adur, and Arun maintain open paths to the sea. Inside of the Chalk escarpment, the drainage is often by subsequent side streams, whose development has been described by various authors. Outside of the escarpment, there are many small streams that may be regarded as shortened consequents, whose beheading was accomplished early in the denudation of the region. The most peculiar feature of the Weald is that the Stour and the Cuckmare should not have ere now been more shortened by the inward growth of subsequent streams from the coast of the Channel between Folkstone and Eastbourne; as it is, the Rother, in the middle of this district, has hardly accomplished any notable depredations.

17. Now, while any one of these many examples from the Tees to the Cuckmare, if taken alone, might perhaps be explained in some other manner than the one here suggested, it does not seem to be within the reach of reasonable probability that so many streams and rivers should repeat over and over again the simple variations of a single theme, unless they had been developed in a uniform and systematic manner. Further, the great number of subsequent streams, well adjusted to the weaker structures of the region, cannot be possibly explained as superposed from a marine cover; they cannot, indeed, be reasonably explained as the product of a single cycle of subaërial denudation; and if they could be, there would then be no explanation for the "upper plains" and the "tablelands" of the Oölite and the Chalk. Taken altogether, it seems that the most probable explanation is the one announced at the beginning of the essay: that the rivers of eastern England are now in the mature stage of the second cycle of subaërial denudation of a great mass of gently dipping sedimentary rocks, and that they have in this second cycle extended the adjustments of streams to structures that were already begun in the first cycle.

THE GREAT SIBERIAN RAILWAY.

By P. KROPOTKIN.

This great line, which is to connect European Russia with the Pacific Ocean, is steadily progressing eastwards. It has already reached the Irtysh opposite Omsk, and will soon reach Tomsk, in the very heart of Siberia; while on the other end of the line, the Usuri river is already connected by a railroad with the shores of the Pacific. Of a total length

of nearly 4700 miles, rails are already laid over 1006 miles—that is, 68 miles more than one-fifth part of the whole distance.

There was at the beginning a great deal of hesitation as to whether Central Siberia had to be reached from the north or from the south. The northern line offers many substantial advantages. It follows the great high-road along which the immense caravans of tea from Siberia, and of all sorts of goods sent from Russia to Siberia, are now transported; and, after having crossed the Urals in the east of Perm, it enters, on the Siberian slope, the regions of rich ironworks, which can supply the railway with rails, engines, and waggons. Then it passes through Ekaterinburg, the centre of all the mining of the Middle Urals, and, turning sharp eastwards, reaches Tyumen, on the Tura. This northern railway, which was completed several years since, is already of great importance. It connects the Kama with the Siberian rivers of the Ob-and-Irtysh system—that is, two immense channels of inner navigation. The Kama, with its large tributaries —Vyatka, Byelaya, Chusovaya—and a basin covering no less than 202,600 square miles, waters in its upper parts a most important region containing a great number of ironworks, and for the last two centuries it has been the chief artery for communication with Siberia. As to the West Siberian rivers, they undoubtedly will maintain their importance for shipping, even after the Siberian railway is completed. Though standing on a small tributary of the Tobol (the Tura), which itself flows into the Irtysh, the present terminus of that railway, Tyumen, must remain a centre of importance for all the traffic in heavy goods coming from Siberia, or shipped from the Urals to Siberia. It must be remembered, moreover, that Tyumen stands in easy communication with the Arctic Ocean, and that long before a more or less regular traffic had been established between Europe and the Yenisei, a little schooner, built at Tyumen and floated down the Tura, the Tobol, and the Irtysh, went to London with a cargo of Siberian wheat. Now, Tyumen stands in regular steamer communication with Tomsk and with Biisk, in the Altai, as well as (*viâ* the Irtysh) with Omsk and Semipalatinsk, on the border region of the Central Asian steppes. True that the Tura, on the banks of which Tyumen stands, is a shallow river which often becomes still more shallow in the summer; but this inconvenience can easily be remedied by continuing the main line for a short distance along the Tura, to its junction with the Tobol. In short, even when the Siberian railway will be completed, the northern Perm-Tyumen line will remain the chief channel of traffic for a wide, populous, and in parts densely peopled and most fertile region, which owing to its thoroughly Russian population, is considered as the granary of West Siberia. Moreover, it brings the chief ironworks of the Middle Urals in direct rail communication with the Kama, which

means, in fact, with the Volga, or with all Central Russia. Therefore, the main line, Perm-Tyumen, 511 miles long, has been very wisely provided with several branches. One of them runs north-west from the Chusovaya station to Bereznyaki, also on the Kama, but higher up, near Solikamsk (130 miles); and a second branch (25 miles) joins the Ostrovskaya station, on the Iset river, with the main line; while this last passes, besides Ekaterinburg, through such important centres of iron industry as Kushva, or Kushvinsk, and Nizhne-Taghil, a mining town of nearly 30,000 inhabitants.

However, this northern line could not satisfy the need of a railway to Siberia. Perm is not yet connected by rail, and will not be connected in a near future, with the railways of Central Russia, because the very thinly inhabited forest tracts which cover the lower Kama between Perm and Kazan belong to the least productive parts of Russia. Altogether, it is a fact, which cannot be too much insisted upon, that the centre of Russian life has been moving southwards during the last thirty years. It is no more in Moscow and the surrounding provinces, but in the belt of fertile black earth which runs south-west to north-east, from Bessarabia to the Urals, that the "density centre" of the population of Russia is now situated. In this belt are those towns of Russia which, apart from the capitals, have populations of over 100,000 inhabitants (Kharkoff, Kieff, Kishineff, Saratoff, and Samara), and become centres of industrial and intellectual life.

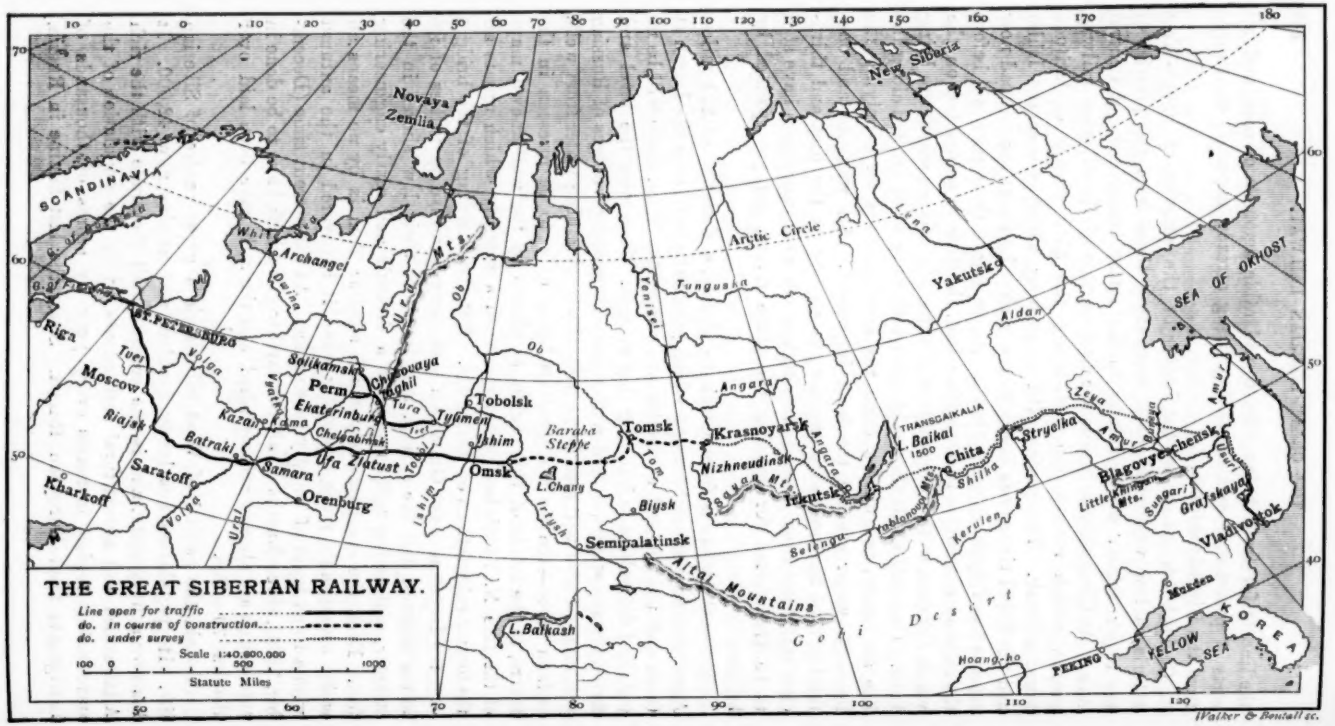
It was, therefore, of first importance to connect the fertile and more densely peopled parts of South Siberia directly with South Russia, and Samara was readily indicated as the head of the Trans-Siberian railway. This young city on the Volga has a population of 100,020 inhabitants, and is rapidly developing; and since the Volga has been spanned by a great iron bridge at Batraki, 76 miles to the west of Samara, this last stands in railway communication with all the railways of Central Russia, its distance from Moscow by rail being 611 miles. From Samara the main line shoots straight east-north-east towards Ufa (224 miles), which is built on the right bank of the Byelaya, at its junction with the Ufa river. Ufa itself has but lately begun to grow, and has only 30,000 inhabitants; but it is situated amidst a very fertile region, rapidly peopled by settlers from the middle provinces, and becomes an important centre of extensive agriculture. Another 200 miles in the same direction bring the railway to Zlatoust (20,500 inhabitants), the rival of Ekaterinburg, and the centre of the great iron and gold mining district of the Southern Urals. The mountains are crossed here in a depression between the mountains Taganai and Urenga; the important ironworks of Miyas are passed by, and Chelyabinsk, 522 miles from Samara, is reached. Up to this little spot, which had in 1891 only 11,200 inhabitants, the railway is quite ready, and there is regular passenger and goods traffic. It must also be said that

the line is far from being idle, considerable amounts of corn and all sorts of produce of cattle-breeding being already exported westwards from the Kirghiz steppes.

Chelyabinsk stands on the border of the prairies of South-West Siberia, a low watershed only separating them from the prairies of the upper Ishim, which belong to the outer borderlands of Central Asia. At Chelyabinsk begins the first section of the Siberian railway proper, which strikes due east, along the 55th degree of latitude towards Omsk. This section, 491 miles long, which crosses the Ishim and the Tobol rivers, has lately been completed, so that the railroad now reaches the Irtysh, opposite Omsk. According to the report laid before the railway committee in December last, the line is completed on the whole distance, with the exception of three big bridges which are being built. One-half of all the buildings which have to be erected along the line are ready, and among them the arrangements for supplying the line with water are not the least important. All waggons and one-third part of the necessary engines are already on the line, and third-class traffic has been opened, although goods and passengers have still to be transferred for crossing the three rivers, not yet spanned by bridges.

The next section is from Omsk to Tomsk, a distance of 350 miles. Apart from two colossal bridges which have to be built over the Irtysh at Omsk and the Ob, and a smaller one across the Tom, there will be no technical difficulties in building that section. It crosses the level and fertile Baraba steppe, dotted with relatively wealthy villages of Russian peasants. There will also be no difficulty in obtaining water from wells or from lakes—the main difficulties being only to be foreseen in the future, as the whole of this region, as shown by the well-known maps of the late N. Yadrintseff, desiccates with a rapidity which upsets all the former calculations of geologists. But the building of the bridges over the Irtysh and the Ob, which both carry immense quantities of ice in the autumn and the spring, and inundate their low shores in the summer, will undoubtedly represent a difficult and costly engineering feat. Even the comparatively much smaller Tom is by no means an easily manageable river, especially when it is covered in the autumn with a thick layer of rapidly moving ice. At the present time (December, 1894), three-fourths of all the earthworks which have to be done in this section are already accomplished, and the rails have been laid over the first 70 miles.

Tomsk, the capital of West Siberia, is a great centre of Siberian life. Its population has lately doubled, and attains now 42,000. It has now a university, and is the centre for all the trade with the rich Altai mines and agricultural settlements, while the population of the surrounding region increases every year by scores of thousands of immigrants from European Russia. Since the last famine in Russia,


THE GREAT SIBERIAN RAILWAY.
Line open for traffic
do. in course of construction
do. under survey
Scale 1:40,800,000
100 0 500 1000
Statute Miles
Novaya Zemlia
New Siberia
SCANDINAVIA
Arctic Circle
Archangel
White Sea
Gulf of Finland
ST. PETERSBURG
Riga
Moscow
Kharkoff
Saratoff
Orenburg
Samara
Ufa
Zlatust
Chelyabinsk
Ekaterinburg
Perm
Solikamsk
Chusovaya
Aghil
Tobolsk
Tyumen
Ishim
Omsk
Tomsk
Baraba Steppe
L. Chany
Biysk
Semipalatinsk
Altai Mountains
L. Balkash
Gobi Desert
Krasnoyarsk
Nizhneudinsk
Irkutsk
L. Baikal 1500
TRANSBAIKALIA
Chita
Shilka
Stryelka
Zeya
Amur
Blagoveschensk
Grafskaya
Vladivostok
Ussuri
Sugari
Little Khingan Mts.
Manchuria
KOREA
YELLOW SEA
PEKING
Hoang-ho
SEA OF OKHOST
Yakutsk
Aldan
Lena
Tunguska
Yenisei
Ob
Irtish
Tura
Tobol
Ishim
Angara
Selenga
Kerulen
Onon
Volga
Ural
Kama
Vyatka
Tver
Riajsk
Batraki
Kazan
Nizhni Novgorod
Petchora
Mezen
Dwina
Walker & Boutall sc.

the number of immigrants to Siberia has rapidly grown to 100,000 every year, so that the immigration had to be organized on a larger scale for alleviating the sufferings of the masses of peasants, who formerly rushed to Siberia without knowing where they would find free land to settle upon, or how they could reach it. Most of them settle in the government of Tomsk. As to the city of Tomsk, its recent rapid growth is chiefly due to its having been brought into regular steamer communication with Tyumen, which, as already mentioned, stands in rail communication with the Kama at Perm. It may, therefore, be safely concluded that from the day Tomsk is brought in uninterrupted railway communication with Russia, the town will grow still more rapidly, as also the population of the surrounding plains and the rich valleys of the Altai—a region much like Switzerland in physical features, but three times as large.

The next section, between Tomsk and Krasnoyarsk, or rather between the Ob and the Yenisei, enters East Siberia. In the west of the Tomsk the railway crosses the *lowlands*, that is prairies, rising only by 200 and 300 feet above the sea; but further eastwards it will have to cross the first terrace of the high plains of East Siberia, which lie over 1000 feet above the sea-level, and are an undulated plateau, intersected here and there by low ranges of hills—the outspurs of the mountains lying further southwards. On this section, 38 per cent. of all the earthworks which had to be made for the railway were accomplished in December, 1894, and it was expected that by January 1, 1895, the rails would be laid over a distance of 200 miles.

The third section, between Krasnoyarsk and Irkutsk, will offer more difficulties. First of all, the railway will have to cross the broad and rapid Yenisei, which flows at a level of 410 feet only at Krasnoyarsk, and immediately after that it will have to rise again to a level of over 1000 feet—that is, to the level of the high undulating plains which fringe the great plateau of East Asia. The spurs of the Sayan Highlands reach here to 2029 feet, while the rivers are deeply cut into the high plains. Of course, such conditions offer nothing which would much differ from the usual conditions of railway building in Middle Russia itself, but in East Siberia the laying down of the rails certainly will not progress with the same rapidity as it has hitherto progressed in West Siberia, while the cost of the construction will be considerably increased. Detailed researches only have been made up till now in this section. But it is well worth mentioning that, at the same time, engineering works have been accomplished on the Angara, in order to clear its bed from the rocky rapids which hitherto stood in the way of navigation on this beautiful river. The Angara connects, as is well known, Lake Baikal with the Yenisei, and now, after the persevering efforts of Captain Wiggins, a water communication between Irkutsk and the Yenisei means a water communication with West Europe. The rapids of

the Angara below Irkutsk are not very dangerous, smaller boats having always navigated in this part of the great East Siberian river, and a little clearing of the bed will, and partly has, set things right; but the rapids between Irkutsk and Lake Baikal will be much more difficult to clear; however, during the last summer some progress was made in this part of the river as well, and the day is not far distant when Irkutsk may become the port of Lake Baikal, although this seemed quite hopeless thirty years ago.

At the present time, only researches are being made for the further continuation of the Siberian railway, and the last reports are that an easy passage has been found across the eastern border-ridge of the high terrace of the plateau—the Stanovoi or Yablonovoi Mountains. This is what may have been expected. As to the western border-range of the same plateau, it will offer no difficulties whatever, as it is pierced by the broad valley of the Selenga and the Uda, which appears as an immense railway trench, rising with a gentle gradient from Lake Baikal (1500 feet) to the Stanovoi water-parting, 4000 feet above the sea. The most difficult part of the railway between Irkutsk and Chita (at the eastern foot of the Stanovoi water-parting) is where it has to follow the south coast of the Baikal, for which purpose a way must be cut through the rocky crags rising abruptly from the waters of the lake. But here, also, the most difficult part of the work was done in 1865–1866 by the Polish exiles, who built the present high-road along the southern shore of the lake, breaking the rocks in Siberian fashion, with the aid of water poured on the rocks after they had been heated by big fires, and allowed to freeze in the crevices.

The real engineering difficulties will begin only when the railway is built between Chita and the Amur, where it will have to cross a series of parallel ranges, through which the lower Shilka has pierced its rocky channel. But a few years will pass before work is started in this part of the Grand Railway trunk.

In the mean time, the railway progresses at its other end, on the shores of the Pacific. A telegram received at St. Petersburg at the end of December last announced that the rails had been laid from Vladivostok to within one mile from the village Grafskaya, on the Usuri—that is, on a distance of 250 miles. Technically speaking, this section offered no difficulties, apart from some marshy places which the line had to cross. The difficulties were rather in the absence of population. But to this difficulty, which also will be met with further down the banks of the Usuri, a new one will be added. The fact is, that the Usuri, like the lower Sungari, and the banks of the Amur between the Little Khingan (Dousse-alin) and the mouth of the Usuri, belong to what Peschel described as "young river valleys." The whole of the middle Usuri region was quite recently (in the later Post-Pliocene times) an immense lake, which only lately began to desiccate. The Usuri and its countless

smaller tributaries have not yet dug out permanent beds across this flat and low country, and every year, in July and August, when the torrential rains brought by the monsoons begin, the whole is transformed into a labyrinth of ponds, marshes, and lakes. This is why the population, which had been settled along the banks of the Usuri at regular intervals of about 18 miles, could cultivate the low ridges only which intersect this periodically inundated land, and, after having vainly struggled for years against nature, permission was given (upon a report of the present writer) to leave those villages, and to settle elsewhere, on the Pacific coast. The Railway Committee having now decided again to repeople this part of the Usuri region by settlers from Transbaikalia, there is great danger of their meeting with the same failures as before, unless, of course, a better exploration of the whole district leads to the discovery of spots better suited for a permanent population. At any rate, the railway engineers will have to contend with great technical difficulties in crossing the lowlands of the Middle Usuri,* and perhaps they will be compelled to seek for a more advantageous direction of the railway, at the foot of the mountains some way off the banks of the Usuri itself.

It must be owned that for some time to come the railway along the Amur and the Usuri will probably remain a mere strategic line. Of all the immense territory which goes under the name of the Amur Region, only the space between the Zeya and the Bureya rivers, in the east of Blagovyeschensk, offers a really rich territory for human settlements, owing to its fertile soil and elevation above the level of the rivers. The remainder, in the north-west of Kumara, is but a valley cut through the high plateau, surrounded by extremely cold and wild highlands; and in the east of the Little Khingan there are but the more elevated flat ridges which are suitable for settlements, while all that surrounds them belongs to the just-mentioned type of periodically inundated marshy low plains.

Quite different is the railway across West Siberia and the governments of Irkutsk and West Transbaikalia. Millions and millons of human beings may find in these regions all that is wanted for a rich development of agriculture and all sorts of industries.

A few words need, perhaps, be added as to the remarkably low cost of travelling to Siberia. Under the present tariff, the distance of 2180 English miles from Granica, on the Austrian frontier, to Chelyabinsk—*viâ* Warsaw, Brest-Litovsk, Vyazona (150 miles before reaching Moscow, where the line starts to Samara), and Samara—is covered for less than £5 (47 roubles) in the third class, and for £9 2*s*. (91 roubles) in the

* It is worth noticing that when the writer went up the Sungari in 1864, he met, on the lower Sungari, with a region of exactly the same character, which the Chinese had abandoned as quite hopeless for colonization on account of its low-lying character and inundations.

second class. Another pound would pay a third-class ticket to the station on the Irtysh opposite Omsk. But even these low fees will be reduced under the new zone-tariff which is going to be introduced.

DR. SVEN HEDIN'S TRAVELS IN CENTRAL ASIA.

[We have received the following communication from Dr. Sven Hedin, dated from Kashgar, November 9, 1894:—]

I have just returned from Mustagh-ata, . . . and send you a short account of the work done during the past summer. On June 21, 1894, I left Kashgar and proceeded by way of Yangi-Hissar and Ighiz-yar to the valley of Gedyek, and thence to that of Kinkol. Having crossed the passes of Chichikli, Kichik, Khatta, and Kokmamak, I reached Tagharma, and advanced by Ulugh-rabat to Su-bashi (July 8). At the latter place there is a Chinese fortress, situated at the western base of Mustagh-ata. Along the whole route I made a topographical map, collected specimens of rocks, and made geological observations which will complete those of Bogdanovich. I regularly made meteorological observations thrice daily with three aneroids and a boiling-point thermometer, and on every opportunity took photographs and studied the mode of life of the Kirghiz.

From July 12 to 25 my camp was situated at Little Kara-Kul and at Bassik-Kul. The whole of this neighbourhood was surveyed with great care, in order to serve as my base of operations for the whole country. Geological, climatological, and other investigations were continued, and numerous excursions made in all directions. Little Kara-Kul is an obstruction lake dammed by the moraines of a glacier which has long since retreated, and is now represented by several small glaciers in the upper slopes of the Mustagh-ata. The moraines of this old glacier, however, still remain, and have blocked the valley of Sarik-Kol in such a way that the water issuing from the glaciers further south accumulates and forms a Lake. Hence Little Kara-Kul is also a settling basin for the river; the glacier water entering at the south end carries in large quantities of glacial mud, while the little stream that issues from the northern end is quite limpid. The alluvium accumulated at the upper end, where it forms an abrupt slope to the deepest portion of the lake. Availing myself of a boat made of skins, I measured the depths at 103 different places. The maximum depth of 78 feet is found in the southern half; the centre in general varies in depth from 50 to 65 feet. The water is clear, fresh, and excellent to drink. Several springs enter the lake at the foot of the crystalline rocks which rise on the eastern and western shores. The stream of Kara-Kul falls into the Ike-bel-su, a river of considerable size during summer, but almost dried up in winter. It forms the upper course of the Gez-daria.

Bassik-Kul (north-west of Kara-Kul) consists of two basins separated by very low ancient moraines. During summer a little stream from the lower basin joins the stream from Kara-Kul. It is a curious fact that there is no visible communication between the two basins of Bassik-Kul, in spite of the two streams which fall into the upper basin. Probably some subterranean communication exists, or the water filters through the materials of the moraines.

Between July 25 and August 19 I visited eleven glaciers on Mustagh-ata, of which six in particular have been very well explored. On three different occasions our camp was pitched at a height of about 14,000 feet. The Kirghiz have no special names for these glaciers, but I have made use of those of the springs, or of the streams found in the little channels of the valleys. The principal glaciers are—Gorumde (towards the north), Sarimek, Kamper-kishlak, Yam-bulak, Tyal-tumak, Tergen-bulak, Chum-kar-kashka (toward the west). Kok-sel, Sar-agil and Shweragil (towards the south-west) are less considerable, the two last-mentioned being almost inaccessible owing to their great height and the gigantic moraines which bar every approach. The most considerable to the north-east is Kok-sel (II.). The Kirghiz say that there are glaciers to the east also, but that they are very small. The eastern slopes of the mountain are almost inaccessible owing to the spurs covered with ice. I tried to surmount these obstacles from both sides, from the south by the valley of Tegerman-su, and from the north by those of Tur-bulung and Kara-Shilga, but was not able to proceed. The motion of even the largest glacier is so slow that I was able to detect a very slight movement during the month of September only by using the most delicate instruments. The greater number of glaciers melt at heights varying from 13,800 to 14,500 feet.* The glaciers were formerly of enormous size, as can be seen from the moraines of gneiss and crystalline rocks which surround the foot of the mountain. Whenever it was possible, I marked on the map the position of the vestiges of ancient glaciers. Even at Bassik-Kul I found erratic blocks of 30,000 to 40,000 cubic feet in size, which were derived from Mustagh-ata.

During this time I thrice attempted to reach the summit of Mustagh-ata, but without success. I had previously made an attempt in April, but on that occasion we were assailed by a blizzard of snow at a height of 18,000 feet. On August 6 I climbed to 19,400 feet, but was then stopped by the unfavourable nature of the ground, which was covered with huge snowdrifts just ready to fall as avalanches. On both occasions we passed to the north of the glacier of Yam-bulak. On the third attempt (August 11) I chose the southern side of the glacier Tyal-tumak. At a height of 18,500 feet we again found ourselves in an

* The figures in the manuscript are indistinct.

extremely dangerous position, where we narrowly escaped losing a Kirghiz and two Yaks that fell into crevices concealed by snow. There is no possibility of reaching the summit by this route, for the great protuberances of ice and the crevasses present obstacles insurmountable even by the most experienced mountaineers.

On August 16 I made the fourth and last attempt from Yam-bulak. As I had found that a single day would not suffice for reaching the summit, I decided to spend the night on the mountain. At 19,400 feet an improvised tent was pitched, and along with five men and eight Yaks I passed a terrible night in the rarefied air, which brought on severe attacks of mountain sickness. Next day a violent blizzard of snow forced us to return with all possible speed. We were half dead in the morning, and, even had the weather been favourable, I scarcely think we should have been able to reach the summit. It must be noted, too, that the slope of Yam-bulak does not lead to the principal summit. There are three peaks, the middle one being the true summit; but in my opinion it is quite inaccessible, not from its height, but from the nature of the ice. The northern summit should be accessible from Yam-bulak—at least, I did not observe anything unsurmountable. This peak is about 1000 feet lower than the middle one, which is about 25,000 feet. I hope some one will visit Mustagh-ata in a few years. It would be of great interest to observe the changes in the condition of the ice and the movements of the glaciers, which will have taken place by that time. But it will be absolutely necessary to make measurements of scrupulous accuracy, without which it would be impossible to come to any conclusions as to the climatic variations which had caused these changes. Bogdanovich visited the front of the Yam-bulak glacier and determined its height fifteen years ago, and I found his observations of great importance.

It is interesting to note that the lower parts of Mustagh-ata, on the north and south sides, bear the famous name of Kara-Koram. The word *koram*, or rather *goram*, signifies "stony ground."

On August 19 I visited the Russian fortress of Murghab, to replenish my stock of provisions. From there I made an excursion to Basar-dere, the Alichur-Pamir, and Yashil-Kul, a lake formed in the same manner as Little Kara-Kul. I returned to Murghab by the Neza-task pass, and proceeded thence to Sarik-Kol by the Sarik-tash pass.

From September 16 to 26 I examined the south-west, south, and south-east slopes of the mountain; thence returned to Kara-Kul and spent ten days there, taking the soundings of which I have already spoken. For our return to Kashgar I chose the difficult pass of Merke-bel, across a glacier nearly a mile wide, and after traversing the valleys of Merke and Chats arrived at my destination on October 19.

In addition to the observations already described, I obtained 170 specimens of rock, chiefly volcanic, a collection of plants from the

slopes of Mustagh-ata and of algæ from Kara-Kul and Bassik-Kul, and a fine collection of sketches and profiles of the glaciers. I am consequently not at all sorry to have changed my original plan of going straight to Lob-Nor. The suffocating heat of summer forced me to turn to the mountains. Throughout I was the only European, and I had none but Kirghiz servants and a Sart of Osh. I made some interesting observations on the migrations of the Kirghiz with the seasons.

I have excellent meteorological, hypsometrical, and topographical instruments, a theodolite by Pistor, a chronometer by Frodsham (8873), which was with Nordenskiöld on his voyage in the *Vega*, another chronometer by Wirén (154), two sets of photographic apparatus (Watson and Eastman) with 1000 plates remaining, craniometers, three guns, with plenty of ammunition, etc.

The fatigue of the past four months obliges me to remain for some weeks at Kashgar to rest, but I shall start for Lob-Nor on an early day in December. My intention is to follow the Tarim as far as the lake, and to try to find the true Lob of the Chinese maps, which Baron von Richthofen has admirably shown must undoubtedly exist. There are many important problems to be found in the Tarim desert, especially those relating to hydrography and archæology.

The expedition to Lob will require four months, and then I shall return probably by Cherchen and Nia to Kashgar. I cannot yet decide by what route to endeavour to enter Tibet; I should like to go by Kangut, but I have not obtained a permit. The ancient route by Kara-Koram is well known, so I must consider the matter further. I have decided not to think of Lhasa at all. It would certainly be a most interesting journey, but of little scientific value. There will always be tourists ready to attempt this adventurous journey. The object of my future research will be the geology of the Kuen-lun range. Above all, I intend to search for traces of the migrations of the Ugurs to Alashan and the southern parts of Gobi. Much remains to be done in Central Asia, and it is a great pity that the modern traveller who journeys for pleasure alone, and has had no scientific training, should not take a scientific man with him, who could give an exact account of the nature of the country traversed from his personal observations.

ADMIRAL BRINE'S 'AMONGST AMERICAN INDIANS.'*

By CLEMENTS R. MARKHAM, C.B., F.R.S.

ADMIRAL LINDESAY BRINE, already well known as the author of the 'Taeping Rebellion in China,' visited America to investigate the mounds and defensive earthworks of Ohio, and the principal ruins of Central America, in 1869. His professional and other duties have delayed the publication of his work, but the interval has enabled him to study the results of subsequent investigations, and the gallant admiral may now be congratulated on the appearance of a valuable as well as a pleasantly written book.

Admiral Brine examined the two largest mounds in Ohio, those of Miamisburgh and Grave Creek, as well as the remarkable defensive works, including Fort Ancient, of all of which he gives careful and interesting descriptions. He is unable to believe that the earthworks in exact geometric shapes can be the work of the aborigines, and is inclined to attribute them to some very early Spanish or French adventurers. But the mounds and some of the defensive works are undoubtedly of native origin, though their age and their builders are difficult and perplexing questions. There is no reason to suppose that the aboriginal inhabitants of the Ohio valley were ever in a much higher state of civilization than they were when they first became known to Europeans; yet the Delaware Indians of the last century only knew of the mound-builders as a distinct people from themselves called Tallegwi, who, in the far-off times, went away south down the valley of the Mississippi, and never returned. Admiral Brine, after comparing the mounds of Ohio with similar works in Guatemala, arrives at the conclusion that the Tallegwi invaded and conquered the Central American region, and were, in fact, identical with the Toltecs who built the temples in Chiapas and Yucatan. It is certain that the Ohio conquerors, if they really extended their migrations so far, brought no knowledge of sculpture or architecture with them. But there is authority for the belief that the chiefs of the Quiché-Toltecs formed a perfectly distinct caste from the people they enslaved, a fact which points to conquest by invaders at some early period.

The Delaware tradition may, however, point to some movement of much less importance. The mound-builders of Ohio are believed, on good grounds, to have been an agricultural race. Mr. Shaler has suggested that it was the coming of the buffalo into the Ohio valley, affording food without labour, that debased the mound-builders from agriculturists to hunters. On this hypothesis, the aboriginal inhabitants, in their mound-

* 'Travels amongst American Indians, their ancient earthworks and temples,' by Vice-Admiral Lindesay Brine (Sampson Low & Co., 1894).

building period, were more advanced than their hunting descendants, though the same people.

From the mound-builders of Ohio the author takes us, in several very pleasantly written chapters on the prairies and the far West, to Central America, where he had opportunities of visiting and studying some of the famous ruins, including Patinamit, Utatlan, Palenque, and Uxmal. Although this field of research has been well worked both before and since, yet the admiral's descriptions and reflections are fresh and interesting, and his book is a welcome addition to the literature of the subject. After very carefully examining the ruins at Palenque, he went on to Uxmal, in Yucatan, and by comparing the two styles he was able to estimate their relative antiquity. At Palenque the temples are built of compact stone and mortar covered with cement, with many human figures of stucco, or graven on slabs. At Uxmal the walls are faced with well-worked masonry, with no coatings of cement and no figures. He concludes that Uxmal is more modern than Palenque, the flourishing period of the latter being from about the eighth to the fourteenth century. Palenque has the advantage of a magnificent site. The ruins stand on heights which form the foothills of the Sierra beyond, with a broad view over the forest-covered plain below, away to the waters of the gulf. The ruins have been restored in imagination by the artistic skill of Viollet-le-Duc, and also in Bancroft's work.

The centre of interest, from Admiral Brine's point of view, is the so-called "Temple of the Cross" at Palenque. The altar tablet is 6 feet 4 inches by 10 feet 8 inches, with inscriptions at the sides. In the centre is the figure supposed to be a cross surmounted by the *quetzal*, or sacred bird. On either side there is a man, well drawn and clothed. That on the right offers something resembling a new-born child to the quetzal, while that on the left is smaller. Admiral Brine holds that the figure on the right is not a priest, but a Quiché chief clothed in the dress described by Juarros. Unable to come to the conclusion that the artistic skill of the people who conceived and executed these sculptures and architectural works was of indigenous growth, Admiral Brine turns to Europe for a solution of the problem. The supposed cross, on which the sacred bird is perched, points, he is inclined to think, to the East; and he suggests that Antilia and the seven cities founded by seven bishops from the kingdom of Don Roderick may be something more than a myth. He quotes the very same passage from Galvano on which Mr. Yule Oldham also relies to support his pre-Columbian Portuguese voyage to America. But if there was any residue of truth in the myth of Antilia's seven cities, there must of necessity have been return voyages to bring back the tale concerning them, and this is not suggested. The general drift of opinion, based on the scientific study of American archæological remains, is certainly in the direction of an exceedingly remote origin for the red race, and of indigenous develop-

ment. The solution of these problems is no longer sought from Manchurians or Malays, or even from Don Roderick's bishops. The builders of ancient times, on the American continent, whether of the mounds in Ohio, of the pueblos in New Mexico, of Palenque and Uxmal, or of Sacsahuaman and Tiahuanacu, probably developed their art by slow degrees, in their own way, and without foreign help. But these are doubtful questions which will require much more research and study before solutions can be reached; and meanwhile Admiral Brine's contribution to the literature of early American civilization is very welcome. It is the work of a painstaking, conscientious investigator, who has carefully weighed the evidence at his disposal, and has arrived at his conclusions after very comprehensive study. Apart from its antiquarian value, the admiral's work forms an agreeable and pleasantly written book of travels.

MRS. BISHOP IN KOREA, CHINA, AND RUSSIAN MANCHURIA.

[THE following letter has been received at the Society from Mrs. Bishop:—]

British Legation, Peking, October 5, 1894.

I think that it is about time that I should give some account of myself. My former letter was sent by my boatmen from Nungchyon to Seul after my five weeks of successful travel on the south branch of the Han. I think I wrote of an accident in a rapid, in which I lost many of my notes and nearly all my negatives taken on the Han.

I went up the north branch of the Han afterwards as far as it was possible to pole and drag a sampon. Returning 30 miles to Nungchyon, I took ponies and went for a week to the Diamond mountain, partly taking Mr. Campbell's route, partly Mr. Curzon's, and partly a new one, returning inland. I then went nearly due east, and crossed a most remarkable pass 4100 feet in altitude, "the Pass of the 99 turns," which descends abruptly on the sea, kept to the coast for 50 miles, turned west to Ampien and Namson, and from thence reached Jenson by the high-road, having spent a very successful and on the whole pleasant two months. At Jenson I left all my travelling-gear, intending to return after the rainy season and continue my journey to the Tumen and Russian Manchuria. The war maimed my plan, and left me with a mutilated half. I reached Chemulpo on June 21 by steamer, intending to go up to Seul, get my money and my luggage, and in a few days go to Japan for the summer. I found Chemulpo occupied by the Japanese, and I was ordered away that night, not into a position of security, but actually into the lion's mouth, *i.e.* on board a Japanese steamer, which sailed that night for ports in the Gulf of Pechili. I was penniless and had only the clothes I wore, and in this state reached Chefu, where the Consul provided me with money, and the wives of the British and Spanish ministers

made up a bundle of clothing. On their kindness I subsisted through the long hot summer, for I only got my money and luggage on September 10, and have still $600 in Seul.

After rolling for some days on the muddy Pechili waves, the captain expecting daily to be made a prize, he decided to go to Newchwang, where we found that the Chemulpo scare had been baseless. I was not then in circumstances to go to Japan, and after a pleasant week at that dreariest and kindliest of ports, I took a "been boat" for the week's voyage to Mukden, my friends not realizing what the result would be of five days and nights of incessant rain. The following day the rain began again, and we were soon entangled in the torrents and currents of the vast inundation 8 feet deep, which has turned the magnificent plain of Manchuria into a malarious inland sea. I saw the destruction of over thirty prosperous villages, and had the happiness of saving some lives. But the storm of wind and rain and the darkness were terrific. I was ill, and lay on my camp-bed for three days in soaked bedding and clothing, the mat-roof of the junk letting in the rain everywhere, and I was so weak when we reached the landing for Mukden that I was lifted into the cart. I have suffered ever since from the effects of malaria and exposure to chill. Just within sight of the house of Dr. Ross at Mukden, the cart overturned, and with the shaft mule rolled down a declivity, and I into the roof and broke my right arm, which, after being in splints and a sling for six weeks, emerged usable, though weak. With this my misfortunes ended. I know now how to appreciate a luxurious room, a good bed, most excellent nursing, and all the luxuries and comforts of carefully tended illness; and my arm was much less painful than I thought a fracture accompanied by a complete smash of the tissues would be.

I spent more than six weeks in Mukden, and was fascinated by it, and had singularly good opportunities of learning much of the inner life and opinions of the upper, *i.e.* the official, class. After the army began to march to Korea, and specially when the undisciplined Manchu troops began to pass through Mukden, great "troubles" began. Mr. Wylie, a Scotch missionary, was beaten to death, and the populace, incited by the soldiers, demanded the lives of the foreigners. I left at a time when it was regarded as a great risk to go the 3 miles to the river, but was quite unmolested, and reached Newchwang after a most pleasant trip, not knowing that I escaped by one hour from an outbreak of piracy and murder, in which my boat was one of those marked for attack. After a week at Chefu and another at Tientsin, where the scare among foreigners was tremendous—if so big a word may be applied to a fright, or state of fear, which appears to me to be without foundation—I came up here, somewhat, or rather much, against the wish of the English minister and consul, who only gave me the pass

because they said I had won a reputation for being "the most prudent of travellers"!

In the five days in a solitary house-boat on the Peiho and on the canal from thence here, I met with nothing perilous or disagreeable, and for a fortnight I have gone about freely here on foot and in a mule-cart, with only my faithful Chinese servant, without encountering hostility or rudeness anywhere, even though I have taken many photographs with my tripod camera. I am the guest, in the absence of Mr. O'Conor, of the secretaries of the English Legation, and have had a very delightful time. Mr. F. Campbell and Mr. Grant Duff are of our "mess." The scare here is fearful, and again I think without reason, and I know the utmost that can be said in its favour. A popular rising against foreigners and a massacre are apprehended, events that I feel sure will not occur so long as the present Government retains a scrap of power, for the interests of its Tartar troops are identical with those of the dynasty. To-night I read a paper for the Oriental Society of Peking (of which I have been elected an honorary member) in the glorious Hall of Dragons in this Legation, to an audience consisting of the whole diplomatic body, the officers of the Chinese customs, and the professors in the Imperial College, and never found people kinder or more sympathetic.

You will see from my story that, owing to the war, I have done very little geographical work, and, except in Central Korea, have not been off the beaten, though not the "globe-trotters'" track. I am purposing to return to England in April, but the fascination which has drawn me six times to the East has increased rather than diminished. Korea is the most uninteresting country I have travelled in. The people seem the dregs of a race. But I think that too much has been made of its difficulties. There is nothing to daunt or especially repel an experienced traveller except the *hot floors!* China is infinitely worse.

Krasnoye Frontier Military Post, Tumen R., Russian Manchuria,
November 24, 1894.

I will add a postcript. Having suffered for four months from malarial illness, I came up to Vladivostock three weeks ago to try the specific of a complete change of climate, which has been so successful that I am now able to do a little rough—very rough—travelling. I also wanted an opportunity of seeing whether Koreans are capable of improvement in better circumstances than those of their own country. I have been up to Hunchun, on the Chinese frontier, and then came down to this post, where three empires meet, purposing to get over the Tumen into Korea; but I have been absolutely baffled, for the first time on any journey, and this though I have been helped by the whole military strength of Russia on her Korean frontier. It is, in fact, too late in the season, but the *coup de grace* to my project has been given by what the

Americans call "the cussedness" of my Siberian ponies. English papers have asserted that Russia "has massed 5000 men on the Tumen river," and this has reappeared in the Anglo-Chinese papers. I have been along the whole Tumen frontier, and there are just *fifteen* men, the garrison at the mud hovel from which I now write. The winter is closing in early. I have already been able to cross the head of Possiet Bay on the ice, but the rivers are in a half-and-half state, and will not be passable till after the time at which the latest steamer leaves for the south. I hope, however, to reach the Usuri by travelling along the Trans-Siberian railroad as far as waggons can go over it. Nothing can exceed the courtesy and hospitality which I have received, ever since I landed, from Russian, civil and military, officials. They have helped me in every way, and, far from showing a tendency to conceal anything, they have offered and supplied information on every point in which I am interested, and have shown me everything, with full permission to photograph whatever I like. I have never been asked for my passport. The military governor of Vladivostock gave me letters to the Frontier Commissioner and others which have been of very great service, and as to the hospitality it is something wonderful. But the story of unbounded kindness and helpfulness is the "old, old story" which every *bonâ fide* traveller has to tell.

I am purposing—I cannot say hoping—to return to England in April by the Red Sea.

DR. TEN KATE'S TRAVELS IN THE INDIAN ARCHIPELAGO.

THE *Tijdschrift* of the Royal Dutch Geographical Society has recently published the illustrated report of Dr. H. Ten Kate on his travels in the Indian Archipelago and Polynesia. This traveller, who had previously made explorations in North and South America, Lapland, etc., was commissioned in 1890 by said Society, and returned to Holland towards the middle of 1893 by way of Australia and Argentina, in which latter country he made a prolonged stay.

The chief object of his investigations was man, anthropologically and ethnologically, although due attention was also paid to natural history and geography in general. Besides Java, Celebes, and other islands, where Dr. Ten Kate made short stays in passing by, the region covered by his explorations was specially the group of Timor, including Timor itself, Samau, Flores, Solor, Adunara, Sumba or Sandalwood, Roti, and Savu. Although some of these islands had been visited by former and recent travellers, physical anthropology remained a desideratum, and many points in their ethnology had to be investigated more thoroughly. Sumba was, in most respects, a *terra incognita*, and about certain regions in Timor and Flores, as, for instance, Belo and Lio, very little was known.

In Sumba, Dr. Ten Kate visited a part of the south-east and the centre of the island, where until then no white man had been. In Lio (Flores) a Catholic priest, Le Cocq d'Armandville, had been for the first time, and Dr. Ten Kate was the second European who went there in his company. In Belo (Central Timor) Ten Kate's farthest point had only been visited by a Dutch Government official, Mr. Kleian.

The following are some of the principal results obtained by Dr. Ten Kate in the Timor group.

All the inhabitants of the different islands explored by Dr. Ten Kate are more or less mixed with Melanesian blood, either Papuan or Negrito, except the Sumbanese. In Savu the Melanesian element is also very scarce. The purest Melanesians were found by him in the village of Hokor, north-east of Sika, Flores, and at Koting, Gehar, and other villages on the isthmus which separates Sika from Maumeri on the same island. Very numerous anthropometric data and a number of skulls were collected among these various peoples, on which subject the traveller is preparing a paper for the press now.

The main results of his ethnological investigations are to be found in his important collections, now in the National Museum at Leiden. Many objects are new to science, and of a great number of others the museum did not possess a single specimen. Ten Kate's collection shows at the same time the parallels and differences between the handicraft, taste, etc., of these various peoples, and throws a new light upon the geographical distribution of certain objects, as, for instance, the wooden pillow, the mask, the blowpipe, the bow, the lance, shell ornaments, etc. But besides this collection, new observations have been made concerning sociology, religious beliefs and practices, psychology, funerary customs, dwellings, toys for children, arrow release, etc., of all these islanders. The first exact description of the megalithic funerary monuments on the island of Sumba, and the finding of Chinese pottery in these graves, is certainly one of the most important points in Dr. Ten Kate's report.

As far as zoology is concerned, the fauna of Sumba was, with the exception of birds and lepidoptera, entirely unknown. The collections and observations made by the traveller have largely added to our knowledge in that respect. About the other islands Mr. Ten Kate also made some interesting discoveries. He found again, for instance, the tiger-cat of Timor, of which the last and only specimen had been seen more than sixty years ago. He afterwards proved the existence of the same animal on the peninsula of Landu, Roti.

Geologically, the collections made by the explorer have largely contributed to our knowledge of West and Central Timor and the island of Samau. The fact that the Triassic formation (upper alpine) was found by Mr. Ten Kate in Central Timor, deserves to be specially mentioned. The geology of Sumba was absolutely unknown. Ten Kate's collections and observations have shown that probably the whole

island is composed of coral rock, limestone, and marl. This last formation has furnished the first elements for the study of sub-fossil foraminifera, which it contains in such enormous quantity, and the study of which was a desideratum as yet for the Indian Archipelago.

As far as the geography is concerned, the principal of Dr. Ten Kate's results may be mentioned here. He was the first explorer who ascended the Lakân, the highest mountain in Central Timor. He gave it the name of Mount Reedtz Thott, and found the altitude to be 6396 English feet. The whole mountain was composed of amphibolite, as shown by Professor Wichmann, after specimens collected by Ten Kate. Another result of this ascension was a better knowledge of the surrounding country. The doctor showed, for example, that Mount Allas, or Alas, which is found on the best charts, does not exist, but most probably must be identified with Mount Kabalaki in Portuguese Timor. The non-existence of a "volcano" on the south coast of Sumba was also shown by the traveller, notwithstanding the fact that it is found on the newest charts. As the regions visited in the south-east and south-centre of Sumba were entirely unknown, all the data he gives in his report on that subject are quite new. A sketch-map of the island of Sumba, also published in the *Tijdschrift*, shows the various itineraries of Dr. Ten Kate, and brings many new names of villages, mountains, rivers, etc.

Of the northern part of the island of Roti, the peninsula of Landu, little was known. Dr. Ten Kate has brought several new data concerning it, particularly about the salt lake called Tasi Poko, which lies in the interior.

THE MONTHLY RECORD.

THE SOCIETY.

Mr. Mackinder's Lectures. — The President, Mr. Clements R. Markham, was requested by the London Society for the Extension of University Teaching to act as examiner on the first series of Mr. H. J. Mackinder's lectures at Gresham College, on "The History of Geography and Geographical Discovery." Mr. Markham's report is as follows: "These examination papers show that nearly all the candidates have acquired a fair knowledge of the subject which has been chosen by them for special study, and a fair percentage evidently possess a good deal more than a mere superficial knowledge. They all show that attention has been given to the lectures, and that an intelligent interest has been taken in them. Some few of the papers show even more than this. There is evidence in them of a successful endeavour to form broad conceptions of the course and tendency of events from the information supplied; and in several cases illustrations are given which show that the students came to the lectures already provided with some knowledge of the subjects discussed. This seems to

be a very great advantage, and of course enables the students to derive increased benefit from attending the course. . . . The examiner, in conclusion, takes this opportunity of expressing his opinion, based on a perusal of the papers, that these courses of lectures on geography are likely to be productive of good, by stimulating an interest in a subject which could not be so well studied in any other way by persons in the position of these young students. The expression of a hope may be permitted that such instruction in London may eventually be placed on a permanent basis." The second series was begun on Monday, January 21, when the President, Mr. Markham, occupied the chair.

The Christmas Lectures.—Dr. H. R. Mill gave, in the end of December and beginning of January, a course of four Christmas lectures to young people in the Map-room. The subject was "Holiday Geography," and the aim of the course was to bring the brighter and more attractive aspects of geography into prominence, and to show how much a little knowledge of geographical principles and methods could add to the enjoyment of a holiday in the country or in a foreign land. The first lecture was devoted to maps as holiday companions, and showed the importance of learning to read and interpret maps in order to get the full benefit of their companionship on a solitary walk or bicycle ride. In the second lecture the nature and uses of geographical pictures were explained. A geographical picture was defined as one that is both characteristic and representative of a special region, taking account either of the land-forms, the vegetation, commercial products, dwellings, means of transport, or the people of the country. Such pictures combined with maps would enable a stranger to form a true and vivid impression of a country he had never seen, and the selection of proper subjects and view-points lend a new charm to amateur photography. The last two lectures were practical applications of the principles laid down in the first two. By means of maps and pictures, shown by the use of two optical lanterns on two screens placed side by side so as to permit of comparison, the geography of the English Lake district and of several alpine valleys in the Tyrol was graphically presented. The lectures were illustrated by more than 300 slides, which were specially prepared, many of them from photographs taken for this course of lectures. An exercise was set at the first lecture, and the prize offered by the lecturer for the best map drawn in contour-lines on a sheet, simply bearing figures of height and depth, was gained by the daughter of a lady Fellow.

EUROPE.

Inland Navigation in France.—A report drawn up by Mr. C. Hardinge upon the recent development of canal traffic in France, illustrated with a map, has recently been issued (Foreign Office, 1894, Miscellaneous Series, No. 342). The report commences with a sketch of the early history of the canal system, followed by an account of the development of canal traffic during the seventeenth, eighteenth, and nineteenth centuries. The system of canals in France in the year

1892 comprised 12,396 kiloms. (7747 miles) of rivers and canals open to inland navigation. Previous to 1879 navigation on canals was confined to local transport, on account of the great diver ity of local conditions in different parts of the country. Now, however, owing to the improvement of the canals and locks, a barge of 300 tons can navigate direct from Havre to the frontier of Alsace (514 miles), or from Dunkirk to Lyons (687 miles). There is a considerable international canal traffic on the north-eastern frontier of France, the canals linking the Scheldt, Lys, Sambre, and the Meuse being connected with the Belgian system of inland waterways, while the canals connecting the Moselle and the Maine to the Rhine, and the Rhone to the Rhine, serve as a means of communication with Germany by inland water. The greater part of this international traffic is with Belgium, of which two-thirds are the importation of coals from the coal districts of Mons and Charleroi. There are still, however, many improvements to be completed on the canals in Bourbonnais and Burgundy. The canal from the Maine to the Saône, and that from the Saône to the Doubs, are at present unfinished, and the extension of navigation on the Rhone awaits the construction of a canal to Marseilles.

Plan of Odessa.—An excellent plan of Odessa, on the scale of 1400 feet to the inch, made in 1894 by M. Dieterichs, and detailed maps of the township of Odessa, with the surrounding *limans*, on the scale of 1 : 42,000, are given in the last issue of the *Memoirs* (*Zapiski*) of the Novorossian Society of Naturalists in Odessa (vol. xviii. 2, 1894), in connection with a paper by Prof. Sintsoff on the water-supply of that city.

ASIA.

Mr. Bent's Expedition to Southern Arabia.—A letter has been received at the Society from Mr. Theodore Bent, dated Muskat, December 11, from which we regret to learn that he has been compelled to give up his project of crossing the desert to Aden. He finds that the party would be twenty-five days without water; an Arab who crossed nearly lost his life. Mr. and Mrs. Bent, with their party, intended to start in a few days for Jofar, on the south coast, and make their way thence to the eastern end of the Hadramut valley, and so complete the exploration of that region. Mr. Imam Sharif had been ill, and so the departure was delayed. Mr. and Mrs. Bent were received in the most friendly way by the Sultan and the British resident at Muskat.

A Recent Visit to Mecca.—At the meeting of the Paris Geographical Society on December 7 last (*Comptes Rendus*, 1894, p. 463), M. Gervais Courtellemont gave a sketch of his visit to Mecca, lately made in execution of a mission entrusted to him by the Governor-General of Algeria. M. Courtellement, who is the author of a series of illustrated works on Mussulman countries, gladly availed himself of this opportunity of becoming acquainted with the centre of the Mohammedan world. He is only the second Frenchman who has visited Mecca and returned in safety. The journey was made, in company with a faithful Algerian attendant named Haj Akli, in the guise of a pilgrim, a new convert to the faith, subject to all the hardships attendant on such a profession. Although looked upon with much suspicion at Jidda, by hurrying his departure the traveller reached his goal in safety, mounted nearly naked on a donkey, with head shaven and bare, having suffered intensely from the cold by night. On arrival he performed the various ceremonies required of the faithful, becoming a guest of the *metuf* of the Algerians, the functionary who supervises the prayers of the pilgrims, and serves generally as guide during their stay. M. Courtellement displayed before the meeting some photographic views which he was able to take in Mecca, and gave details as to its political and commercial relations, and the manners of its inhabitants.

West Borneo.—M. Maurice Chaper contributes to a recent number of the *Annales de Géographie* some notes on a recent voyage to Borneo, undertaken for industrial and scientific purposes. He visited the western part of the island (Wester Afdeeling), and ascended the Kapœas for 400 miles. It is a narrow winding river, bordered by magnificent nipas (*Nipa fruticans*) forming a dense hedge, beyond which lies the flat and muddy area of the delta. A numerous population lives by fishing and cultivating rice and bananas. The coconut palm abounds, but the vegetation is ill adapted to animal life, which is conspicuously absent. Pontianak, at the confluence of the Landak and the Lesser Kapœas, the capital of the Wester Afdeeling, has a large import trade, especially in rice, which cannot be grown owing to the barren clay soil and the double danger of drought and inundation. The same pale yellow clay covers the greater part of the basin above Sintang, the second town, at the junction with the Melawi. A small river, the Penindoe, presented a striking contrast, with magnificent forests, luxuriant vegetation, and orchids in splendid profusion. The Dyaks have suffered by contact with Europeans, who have acquainted them with vices and diseases previously unknown. Much land has passed from cultivation, industrial arts have retrograded, and the population is fast diminishing. It is difficult to say how far the basin of the Kapœas is typical of Borneo. The north and north-west are probably more capable of exploitation, as tobacco, sugar, and pepper grow well, and Sarawak also possesses coal. The trade in gutta-percha needs careful superintendence, as the tree is disappearing in consequence of the reckless methods employed. The productive zone is roughly indicated by a line drawn from Pontianak, following the ridge between the Kapœas and the Landak, joining the crest of the Batang-Lœpar range, and crossing the Kapœas highlands in an unknown direction.

AFRICA.

Mr. Weld Blundell in the Cyrenaïca.—The following letter, dated "Fountain of Apollo, Cyrene, Dec. 4, 1894," has been received from Mr. H. Weld Blundell: "I have experienced great good luck in this journey, especially in falling on a sensible and straightforward Pasha of the district. I had no obstruction or official difficulties of any sort, and am comfortably settled here, a few yards from the classical spring of Apollo at Cyrene, after a most delightful journey through the Cyrenaïca. The rhapsodies of former travellers scarcely do justice to it. It is like a ten days' ride through the Malvern Hills and Shropshire, if you could imagine all the evidence of human beings in the way of buildings, etc., removed, and arbutus, laurustinus, and juniper, etc., instead of oaks and elms. Stretches of beautifully fertile plains, with rich red soil covered with flowers and shrubs, and well-sheltered valleys and glades of fine short grass, not like the ordinary coarse growth of the tropics, but like an old pasture, and even a lawn-tennis ground! There are whole square miles like an English park, and one almost expects to see a head-gardener appear to warn you off the grass. In spite of this, I do not think that, with the exception of a little village called Merj (ancient Barka) and this place, I have seen fifty inhabitants in the whole journey from Benghasi. The climate is now like a fine September in Scotland, but, of course, drier, and the sun at midday is, of course, hotter. We are just under 2000 feet above sea-level, and have a grand view over the ancient road from Apollonia over a rich green plain of the terrace below us, whence the road descends by a sharp incline to the sea, which stretches away before us to the north and north-east. I hope to be some time here, and visit the important points along the coast. Possibly I may be able to get inland."

Russian Expedition to Abyssinia.—The Russian Geographical Society has sent out an expedition to Abyssinia and the surrounding regions, which is now on

its way. It consists of A. K. Léontief, who has supplied the chief means for the expedition; the well-known traveller, Dr. Eliséeff, who undertakes to make natural history observations and collections; the artillery officer, Zvyaghin, who will make the astronomical observations and do topographical work; M. Agapoff, a naturalist from the museum of the Academy of Sciences; and the Abyssinian, Rass-Lig Rerd, acting as an interpreter. The expedition will proceed, *viâ* Suez, to Obok, where a caravan will be organized to journey across the desert to Ankober and Antoto, thence into the highlands of Northern Abyssinia, and, if possible, into the Sudan. It is proposed to spend two years in these journeys.

Exploration of Mount Mlanji, Shiré Highlands.—Mr. Alfred Sharpe, acting commissioner in Nyasaland, has communicated to the Foreign Office the account of an exploration of Mount Mlanji, which has also been described by Captain Manning, one of the party who accompanied him, in the *British Central Africa Gazette* for November 24th last. Although the south-western plateau was already well known, and promising to speedily become the site of a flourishing settlement, the rest of the range, especially its north-eastern half, had previously been little known. It was on this side that the ascent was made from Fort Lister. A striking feature of the mountain on this, as well as the south-western side, is the existence of an outer ledge, 6000 feet above sea-level, or 3000 feet above Fort Lister, separated by a ridge 8000 feet high from the main north-eastern plateau. The latter contains the sources of the Ruo river, which extend so far to the north (being separated only by a few yards of level ground from those of the Likulezi) as practically to cut the mountain in two. This north-eastern plateau—entirely separated from the south-western by a succession of high rocky peaks with deep gorges between—is described as a grim-looking spot, surrounded with towering walls of bare granite, of which the eastern extension of the mountain appears entirely composed. The grass in the lower valleys was delightfully green, and the plateau should, Captain Manning says, be an ideal sheep farm or cattle ranch. The route hence was continued by an exceedingly difficult pass through a gorge between the central peaks, and after some extraordinary feats of climbing, often in thick mist, the last rocky pinnacle of the highest peak was reached, 9680 feet above sea-level. Thence a descent was made by an easier route to the south-western plateau, of the advantages of which, for a sanatorium, Captain Manning speaks in high terms. Forests of the Mlanji cypress (*Widdringtonia Whytei*), which is peculiar to the mountain, were met with in many parts of the higher regions, and there are indications that at one time the whole mountain above 6000 feet was covered with them; but their extent has been gradually diminished by the grass fires, so that they are now in parts limited to the gorges. Mr. Sharpe remarks on the necessity of taking steps for the protection of these groves, which supply a most valuable timber, for the utilization of which he has started saw-pits at Fort Lister. A good road has recently been made across the plains to the station from Zomba, and the distance can now be done, if necessary, in one day. There is no population in the intervening tract, in which water is somewhat scarce in the dry season.

The Flora of Usambara.—Among the scientific researches carried out in recent years by the Germans in their various African protectorates, those into the Botany of East Africa by the late Carl Holst deserve special mention for the value of their results. In the desire to gain a knowledge of Africa at first hand, this energetic collector entered the service of the German Missionary Society, acting for some time as gardener at the station of Hohenfriedeberg, in Usambara, and afterwards became collector for the Berlin Botanical Museum. The care with which he carried out his instructions in recording the needed information as to

the *habitat* and conditions of growth of the individual species give an additional value to his collections, which number in all about 4600 plants. These have been dealt with in Berlin by various botanists, and the results published from time to time in Engler's Botanical Year-book. Two more general summaries of the results in special directions have lately appeared, one a treatise by Prof. Engler himself on the subdivision of Usambara into separate Botanical Regions (published in a separate form by the Berlin Academy of Sciences), the other an account of the cultivated plants of the same country, by Dr. O. Warburg (*Mitt. aus d. Deutschen Schutzgeb.*, 1894, p. 131). The former, after noticing some of the main generalizations as to botanical distribution in Africa, which our limited knowledge of its flora allows us at present to make, and showing the importance which attached to the discovery of the affinities, both of the forest and upper mountain flora of Usambara, proceeds to discuss the considerations of soil, altitude, character, and degree of denseness of the vegetable covering which should determine the subdivision into botanical regions or "formations." Of these he defines eight in the district dealt with, viz. the shore and creek-zones (the latter recent limestone), the bush-land of Jurassic limestone, the "Nyika" steppe, the broken bush-steppe lying before the mountains, the tropical mountain forest, the higher tracts almost devoid of trees, and lastly the upper mountain forest, occurring higher than 5500 feet. Prof. Engler analyzes the constituents of the flora of each of these regions (which are again subdivided according to the particular characteristics of individual areas), and draws the following general conclusions. The first zone shows an agreement with the shores of the Indian Ocean generally. The second, while also possessing some forms in common with the shores of Tropical Asia, belongs in the main, like the next three zones, to the region of steppes and savannahs, interspersed with bush, which occupies so much of the continent from Senegambia to Abyssinia, and thence to South Africa, encircling the Congo basin westwards as far as Angola. The seventh and eighth zones show much affinity with the Abyssinian uplands, while the sixth, or zone of tropical forest, though including some savannah species, in the main is allied, not to North, South, or East Africa, but to the tropical forests of West Africa from the Senegal to the Congo. In view of the undoubted uniformity observable in the African tropical forests in various parts of the continent, Prof. Engler is of opinion that the forest, rather than the steppe flora, had a former greater extension, there being in East Africa a greater area favourable to its growth, while the ancient tableland possessed a greater continuity, and presented a larger surface to the sea-breezes. On its inner border there would always have been a drier zone, which would aid the extension of the Xerophytic flora.—The fact that the Washambaa, or inhabitants of Usambara, are among the most advanced agriculturalists of Central Africa, growing more produce than is needed for their own consumption, gives a special interest to the study of the cultivated plants of their country. Their name even has been connected with the word "shambe" (field or plantation), and so with their proficiency in this respect. In spite of the primitive means employed, they show a considerable knowledge in respect of alternation of crops, the best times for planting and reaping, and the various methods of culture suitable to different crops. They also pay particular attention to irrigation, which enables them to some extent to utilize the dry season for cultivation. Dr. Warburg classes the cultivated plants into thirteen natural groups, beginning with cereals and other food-plants, and coming later to those supplying fibres, dyes, medicinal substances, etc. The result of the detailed examination of these separate groups is to show that the Washambaa possess a really important number of cultivated plants, some of the most important falling under the following heads: cereals, 2 (maize

and sorghum); sugar-cane; tuberous plants, 7; pulses, 7; various vegetables, 9; fruits, 6; fibre-yielding plants, 5; besides various others used for condiments, etc. Dr. Warburg thinks that there is still room for improvement in the direction of increased cultivation in the dry season with the help of irrigation, and especially in the early, cooler part of the same, by the introduction of extra-tropical economic plants.

Physical Geography of the Southern Congo Basin.—The Bia-Francqui expedition, the general results of which have already been fully noticed in our pages, has thrown much new light on the geology of the regions traversed, thanks to the investigations of Dr. Cornet, one of its members. The results in this direction are described by him in *Petermann's Mitteilungen* (1894, No. vi.), and illustrated by a sketch-map showing the principal formations represented. Owing to the absence of fossils, these cannot yet be assigned to groups established elsewhere, but can only be classed according to their general petrological characteristics. Of recent surface formations, Dr. Cornet distinguishes (1) the soil formed by the decomposition of rock *in situ*; (2) the deposits at the sides of the valleys, including beds of rolled pebbles and gravel; (3) the alluvium of the valley floors. The first occurs chiefly on the plateaux, and may be considered as analogous to laterite; the second, along the course of the Lualaba; and the third, which includes both the deposits of the yearly inundations, and those formed on the floors of old lakes now drained, is found in various parts of the Lualaba and Lufira valleys. Next in order come two series of conglomerates, etc., in the main horizontal, occupying a large area in the central Congo basin. They consist of sandstones, shales, etc., of various characters, and attain their greatest development on the Lubilash and the Kundelungu plateaux respectively. The more southern parts of the Congo basin are in the main occupied by high lands, composed of much-folded ancient strata, which, along an axis running from north-east to south-west, have been subject to metamorphism, both from the intrusion of eruptive masses and from mechanical movements. This axis divides the ancient rocks into two distinct series (that to the south-east in the basin of the Lufira being the more extensive), each again to be subdivided into separate groups. Eruptive rocks are met with both in the region of the metamorphic axis and in various localities on either side of it, notably on the Luembe and Lubichi, tributaries of the Lubilash. They are mostly granitic in character.—The surface features of a portion of the country traversed by the same expedition, viz. the Samba plateau, at the sources of the Sankuru, Lomami, Luvoi, etc., are described by Lieut. Francqui and Dr. Cornet, in the *Mouvement Géographique* (1894, No. 16). It has a regular, slightly undulated surface, with a sandy soil, in many parts mixed with humus, and gives rise to a remarkable number of streams, which within its limits flow in scarcely marked valleys, these, however, becoming more and more deeply cut as they reach the limits of the region. It is in the main occupied by savannahs, mostly sprinkled with trees of no great size. Its name is that of the race which inhabits it, several of whose villages, of large size, are to be met with on it. The people cultivate much manioc, and rear numbers of goats and poultry. Iron is worked everywhere. Caoutchouc is exported through the Bihé traders. The Samba are great thieves, and seize and sell as slaves all stragglers from caravans which pass through their country, possessing themselves of the goods entrusted to them.

AMERICA.

Geographical Work on the North American Pacific Coast in 1894.*—The principal geographical work on the Pacific Coast of the United States

* Communicated by Prof. George Davidson, President of the Geographical Society of the Pacific.

during the last season was that executed by four or five parties of the United States Coast and Geodetic Survey in the south-eastern arm of Alaska, in compliance with act of Congress for the determination of the boundary-line between British Columbia and the United States. Necessarily this work has been prosecuted up the principal waterways, as was done in the preceding season. The southernmost party finished its work on the upper part of the Unuk river, a small and torrential stream little frequented, and within 30 miles marked with two deep, narrow canons, very difficult of passage even with the ice-shelves on each side. In summer the Indians make a portage of 3 or 4 miles. When the party had finished its work the ice-shelves were gone, and in the rapid current one of the boats was upset, the instruments lost, and the officer and men barely escaped with their lives. Another party executed the triangulation and topography up the Chilkoot river for a distance of 30 miles. This is now the usual route for miners going into the Yukon valley. Another party executed similar work up the Chilkaht river, and recovered the station of the American total solar eclipse expedition of 1869. The Unuk party operated in the estuary of the Chilkaht, and carried the work to the Seduction Point of Vancouver. It embraced the face of the Davidson glacier, which, coming from between peaks over 6000 feet high, projects far into the deep waters of Lynn Canal with a frontage of 4¾ miles. The great rocky terminal moraine is covered with a heavy growth of firs, which have been broken through in one place within the last few years. Two parties were located at Yakutat Bay; one executed the triangulation towards the base of Mount St. Elias, and the other had an astronomical station at Port Mulgrave, whence chronometers were exchanged with the astronomical station at Chilkaht, and the principal station at Sitka. The triangulation party is the same that determined the latitude and longitude and height of Mount St. Elias; placing that peak in 60° 17′ 34·4″ N. and 140° 55′ 19·6″ W., and the elevation at 18,017 feet. In that triangulation Mount Logan, about 17 miles north-eastward of St. Elias, was placed in latitude 60° 34′ 00·7″ N. and longitude 140° 23′ 48·9″, and the elevation fixed at 19,512 feet. The adjoining peak, about 2 miles distant, has an elevation of 19,276 feet. At Sitka, which has been well connected with San Francisco by telegraph and by chronometers for difference of longitude through many seasons, an astronomical station was established to correct the rates of the chronometers transported by the Coast and Geodetic Survey steamer *Hassler* between Sitka, Chilkaht, and Port Mulgrave in Yakutat Bay. At this station the magnetic elements were also observed, as at every occupation since 1867. Among the Aleutian Islands the United States Fish Commission steamer *Albatross* has made corrections to some of the positions of the western uninhabited islands, and has written up descriptions of some of the outlying rocks for the benefit of navigators. Through Captain Gustave Niebaum, of the Alaska Commercial Company of San Francisco, and Captain Healy, of the United States Revenue steamer *Bear*, arrangements have been made with Alaskan and Siberian chiefs to afford to Lord Dunmore assistance and provisions in his proposed crossing of the strait on ice. Some have doubted the strait being frozen solid in winter, but as the solid ice frequently reaches through Bering Sea to St. Paul Island, there can be no doubt whatever but that Lord Dunmore will find a solid but rough causeway from America to Asia by this route.

The Age of Niagara.—Professor J. W. Spencer sums up the conclusions of his observations on the physical history of Niagara Falls in a short paper in the December 1894 number of the *American Journal of Science*, in which he takes account of the opposed action of erosion by the river and distortion by unequal movements of the land, even venturing to predict the probable order of future changes. He states that "the computation of the age of the Niagara river, based

upon the measured rate of recession during forty-eight years; upon the changing descent of the river from 200 to 420 feet and back to 320 feet; and upon the variable discharge of water from that of the Erie basin only, during three-fourths of the life of the river, to afterwards that of all the upper lakes,—leads to the conclusion that the Niagara Falls are 31,000 years old, and the river of 32,000 years' duration; also that the Huron drainage turned from the Ottawa river into Lake Erie less than 8000 years ago. Lastly, if the rate of terrestrial deformation continues as it appears to have done, then in about 5000 years the life of Niagara Falls will cease, by the turning of the waters into the Mississippi. These computations are confirmed by the rate and amount of differential elevation recorded in the deserted beaches. It is further roughly estimated that the lake epoch commenced 50,000 or 60,000 years ago, and there was open water long before the birth of Niagara in even the Ontario basin, and that under no circumstances could there have been any obstruction to the Ontario basin, if even then, later than the end of the Iroquois episode, which has been found to have ended 14,000 years ago."

Lake Superior.—The United States Hydrographic Office has published the first volume of a set of sailing directions for the Great Lakes, dealing with Lake Superior and its approach. Here for the first time we have an official description of this "Brother to the Sea," as an Indian chief named the lake; but greater care in revision would have been desirable—for example, in the same sentence the maximum depth is given as 1008 feet, "but depths have been found as deep as 1386 feet." The navigation of the lake is usually open from the middle of April to the middle of December, when it is closed by ice. The sea-like character of the lake is strongly enforced by the sailing directions. Plans are given of the chief harbours and of the channel and canal on St. Mary's river on the American side, the capacity of which is about to be increased, but no particulars of the new canal on the Canadian side of the river.

POLAR REGIONS.

The Jackson-Harmsworth Expedition.—Mr. Arthur Montefiore writes to us with reference to a paper recently published in the *Comptes Rendus* of the Paris Geographical Society, in which M. Rabot dwells on the present position of the expedition, drawing his facts from a paragraph which appeared in the press in September last. Mr. Montefiore points out that the paragraph was not only misleading in its statements, but has actually been superseded and nullified by later news. This later news, which appeared in the press on October 8, seems to have escaped the notice of M. Rabot and those who have drawn attention in English papers to M. Rabot's paper; and for the sake of placing on record in the *Journal* the latest news received of the expedition, Mr. Montefiore asks us to reprint a paragraph which he communicated to the *Times* of October 8, as follows: "News of the Jackson-Harmsworth Polar Expedition has been brought to England by Mr. J. Russell Jeaffreson, who obtained the information at Thorshavn from the captain of the *Betsy*, a walrus sloop recently returned from her summer voyage in the Barents' Sea. It appears that the captain first saw the steam yacht *Windward* near the well-known Matochkin Schar, where the ice was very heavy, about the middle of August. Returning west towards the end of August, he again met with the vessel in latitude 75° 45′ N., and longitude 44° E.; but on this occasion she was steaming in the direction of Franz-Josef Land without let or hindrance, the ice being in this locality brashy and rotten, the *Windward* actually steaming up a lead of which no termination northward was visible. The captain of the *Betsy*, though unable to distinguish the name of the ship, describes her accurately, and from the positions in which she was seen and the respective dates there is no reason to doubt that his report relates to the *Windward*. It is worth mentioning that this report is

precisely what might have been expected, as Mr. Jackson hoped to find a region of loose, brashy ice about 45° to 50° E. long., and, after getting abreast of the Matochkin Schar, intended to make directly for it."

Mr. Burn-Murdoch's Impressions of the Antarctic.—Mr. W. G. Burn-Murdoch, whose finely illustrated account of the voyage of the *Balæna* to the southern ice was recently published,* describes in forcible language the rough life and hard work on a sealing cruise; but as an artist he caught the picturesque aspect of even the most uncomfortable experiences. His description of ice-scenery is singularly vivid, and he appears to have been deeply impressed by the importance of Antarctic exploration and attracted by its fascination. We quote without comment the following extracts: "Much to our regret, we had no opportunity at this time of meeting Dr. Campbell of the *Diana*. He, we understand, has been more fortunate than we on the *Balæna*, for Captain Davidson gives him every opportunity of collecting specimens. If we lay hold of glacier rocks or birds' skins we raise a whirlwind of objections, and an endless reiteration of the painfully evident truth that 'this is no' a scientuffic expedeetion.' A most painful state of things this, to see common albatross-skins collected by the score, and rare penguins killed by the hundred, their bodies eaten and their skins chucked overboard" (p. 244). "Would that I owned this ship and this good crew even for three summer months in the Antarctic! Just such a vessel as this could be chartered and fitted out with men, scientists, provisions, and all necessaries for a year's exploration for about £5000. If monetary profit was to be considered, 5 per cent. might be reasonably expected for seal-skins and oil, and, of course, there is the chance of meeting 'Bowheads' worth £3000 apiece. One vessel or two in consort could chart the whole of the unknown Southern Continent. Think of this, ye rich, who dream of knighthood and more riches!" (p. 290).

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Percolation of Sea-water.†—From his discussion of the material collected during the fourth expedition of the *Pola* in the Eastern Mediterranean, Dr. K. Natterer, the chemist of the expedition, advances an hypothesis of peculiar geographical interest. Some observations on the crusts which in many places cover the mud on the sea-bottom to a thickness of from ½ to 4 inches, as well as the fact disclosed by a large number of analyses that the mud water is neither entirely stagnant nor in free circulation, indicate that as a general rule water is percolating through the capillary pores of the mud, and being sucked in by the underlying rock strata. Besides the slow movements of water-particles caused by diffusion, which takes place upwards and downwards in the mud to nearly the same extent, there is, according to this hypothesis, another movement, always more rapid than the other, but differing in different regions, and always downwards. Fresh quantities of sea-water are thus constantly being drawn into the superficial layers of the mud, and there is no means of carrying away the products of its chemical action. Natterer remarks that such percolation of water through the mud may be assisted by the whole mass of land rising above sea-level, as well as by that actually underlying the sea-floor, as far as the temperature and viscosity of the water permit; and it may be in part due to chemical absorption, also in part to purely mechanical processes. Immense areas round the Mediterranean basin—such as the Sahara—are practically rainless, and in so far as they are connected with that basin by the

* 'From Edinburgh to the Antarctic.' An artist's notes and sketches during the Dundee Antarctic Expedition of 1892-93. By W. G. Burn-Murdoch. London: 1894. Longmans, Green & Co.

† Communicated by our Vienna correspondent.

lie of the geological strata, they may act like a sponge in sucking up water from the sea. A capillary movement of water through the layer between land and water, caused by the joint action of the land itself and of forces acting at its dry surface, must produce many important chemical changes in the substances immediately concerned, as Bischof has assumed, and in part proved to be the case with regard to the drainage of fresh water through sedimentary deposits. According to the rate at which sea-water soaks in and to the nature of the reactions set up, the effects on the land itself must vary, and its influence might be traced in the appearance of petroleum, of exhalations of carbonic acid gas, of sulphuretted hydrogen, and (in deserts) of salt deposits. The meeting of fresh drainage water with the rising sea-water must also give rise to a whole series of reactions, which may, for example, determine the distribution of metallic deposits, or help to fix the ultimate position of meteoric or cosmic dust reaching the Earth's surface. The mingled waters would in most cases—according to Natterer—move towards the Earth's surface, and reach it through springs, from which the return to the sea would be accomplished by streams and rivers. The recognition of an agent of this nature would have great influence in dealing with many geological problems, and Natterer finds proof of the existence of capillary circulation of sea-water in the slow changes of the depths of the sea and the heights of the land. In one place an elevation may be produced by chemical precipitation, in another a depression by dissolving out; land may disappear in the ocean, and a sea-bottom be raised above the waters; and these movements may be accompanied by faulting, displacement, and fracture. [If it be demonstrated, it would confirm the ancient speculation of the Greek physical geographers, who attributed the origin of springs to the sponge-like action of the land in sucking up water from the sea. It is a physical problem, however, whether water raised by capillarity can be delivered at a higher level, except indirectly as a consequence of evaporation.—Ed.]

The Exploration of the Sea of Marmora.—At the December meeting of the Russian Geographical Society, N. I. Andrusoff read a paper on the submarine explorations made this year by a Russian expedition in the Sea of Marmora, on board the Turkish steamer *Selanik*. It appeared from the soundings that the Sea of Marmora has three separate deep basins, and that, by its salinity and temperature, it is more closely related to the Mediterranean than to the Black Sea. From the geological work of the expedition, it results that the Black Sea was connected with the Mediterranean before the Sea of Marmora had been formed. The latter existed first in the shape of a brackish basin, connected with the Black Sea, but not with the Mediterranean; the latter connection having only been established at a later epoch, probably in consequence of a subsidence of the Ægean area. The formation of the Marmora basin itself is probably due to periodical subsidences of its bottom, which produce the earthquakes visiting this region.

Physical Geography in the University.—In a paper bearing this title in the *Journal of Geology* for 1894, Professor W. M. Davis, of Harvard, gives a powerful exposition of the possibilities of physical geography, and especially the systematic study of land-forms as an intellectual exercise. For this purpose it is necessary, as in all other branches of science, to employ terms with definite and exclusive meanings. Professor Davis has introduced many such terms, with which European geographers require to familiarize themselves before they are able to fully appreciate the remarkable comprehensiveness and precision of his generalizations. The University method of geographical education which he employs is first the examination and classification of a large number of facts in the geographical laboratory, using typical maps and models as a substitute for the actual land-forms. Finding that the inductive method does not lead to profitable results, he proceeds

to elaborate a system of deductive geography. The primary fact is that the wasting forces of erosion tend to wear down to an ultimate base-level any form of elevated land surface. An elevated surface is termed *constructional*, the wasting forces *destructional*, and the series of changes including the construction of a land surface from a plain and the destruction of the surface to base-level again is termed a *geographical cycle*. At the commencement of a cycle a system of *constructional drainage* is established, depending on the forms of the land. This stage passes at once into the system of *consequent drainage* when the streams, following the *trough-lines*, proceed to *degrade* and *aggrade* their channels. Differences in the hardness of strata traversed give rise to *subsequent* forms of cascade or valley in the course of the consequent stream. The *divides* and *stream-profiles* also undergo subsequent change; the river-beds grow flatter, the streams slower, and their erosive work more feeble. Thus the stages of infancy, youth, adolescence, maturity, old age, and second childhood may be distinguished in a geographical cycle. Many complications are introduced in the complete study of a cycle, and a large number of additional terms must be employed to define them. Professor Davis insists on the absolute necessity of clear thinking and continuous mental effort on the part of the student under this system, and on the importance of a large and very carefully selected series of characteristic maps to illustrate each stage of the geographical cycle. "When thus developed," he says, "physical geography may worthily claim the dignity of a University study. Its subject-matter is of importance in itself, as well as in its relations to geology, zoology, and botany, or to history and economics. Its methods are of value in training various mental faculties, observation, description, generalization, imagination, comparison, discrimination; these are all cultivated to a high degree in the student who successfully utilizes the opportunities of the course."

GENERAL.

The "Challenger" Publications.—We understand that the last two volumes of the *Challenger* Reports are now in the binder's hands, and will be issued immediately, thus bringing to a conclusion the twenty years of active scientific work which were required to discuss the mass of new observations and material collected on the famous cruise. The completed set of volumes, which numbers fifty, forms an encyclopædia of Oceanography, every chapter of which is written by a prominent specialist, and the whole work planned and edited, first by the late Sir Wyville Thomson, and latterly by Dr. John Murray, who writes the general summary of results in the concluding volume. The work has been carried through at the expense of Government, and we believe that about one hundred complete sets remain in the warehouses of the Stationery Office. The proper disposal of these is a matter of the greatest importance, and it is most desirable that this, the greatest work on Physical Geography ever produced, should be rendered accessible to all geographers and scientific workers who are capable of making use of it. For this purpose it would be necessary to draw up a list of the principal universities and scientific libraries in all parts of the world, and select from them those which, in the opinion of an impartial committee, should receive presentation sets, or, in case of the Government not seeing its way to gratuitous distribution, which should be afforded an opportunity for purchasing, at cost price, before the work is offered to the general public. This is a case in which the purchase of even a single set by a private individual is a loss to science, for no one man could possibly make use of the whole work. The approaching Geographical Congress would furnish a good opportunity for the appointment of an International Committee to advise on the most useful disposal of copies; and our Government could, by a single well-timed act of generosity, repay all foreign nations for their unstinted gifts of national publications to the institutions and libraries of this country.

The Geographical Association.—This Association, which was started in 1893 with the view of improving geographical teaching in public schools, held its first annual meeting on December 21, at the Royal Colonial Institute. Mr. G. R. Parkin occupied the chair, and the reports of the secretary, Mr. B. Bentham Dickinson, and of the treasurer were read. The Association has, mainly through the enthusiastic services of Mr. Dickinson, arranged a nearly complete system of educational maps and pictures in the form of lantern slides. These are in sets dealing with the different continents and the more important countries, and are lent out to the schools which have joined the Association. At present seven schools make use of these slides, viz.: Rugby (where Mr. Dickinson is an assistant master), Fettes, Haileybury, Marlborough, Shrewsbury, University College School, and Nottingham High School. Mr. H. J. Mackinder then gave a most suggestive address on geography as a training for the mind, which we hope to print in the *Journal* at an early date, and the meeting concluded with a practical demonstration by Mr. Dickinson of his method of teaching by aid of the Association's lantern slides. We understand that the Geographical Association is endeavouring to raise the position of geography in education by bringing before various examining bodies the importance of giving more value to geographical answers, and the necessity in many cases of setting more reasonable papers, the preparation for which may be made an occasion for a rational system of teaching.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1894-95.

Fourth Ordinary Meeting, January 7, 1895.—CLEMENTS R. MARKHAM, ESQ., C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Walter H. Brown, C.E.; H. Fredk. John Burgess; George Leiper Farnum; James Edward Farnum; H. W. A. Harrison (Barrister-at-law); William Thomas Rabbits, F.L.S.; Henrik Vroom; Arthur Ll. Griffith Williams; William John Woodhouse, B.A.*

The Paper read was:—

"A Visit to the Luchu Islands." By Basil Hall Chamberlain.

The PRESIDENT said: In opening the first meeting of the year, I wish to express my gratification at the very large number of Fellows who were able to respond to my invitation to the reception last month, when they had an opportunity of seeing for themselves their own premises and their own possessions, I hope in an agreeable way. I must also take this opportunity of referring to the letter that has been sent round to the Fellows, on the subject of the International Geographical Congress. When we were directly invited to have a congress in London, it was quite unavoidable that we should do so, and we must now do our best to make it a success. A great deal will be expected from us, but I feel sure that my associates will work to make it as great a success as it ever has been in any other country. For we must not only do as well, we are bound to do better, than our friends abroad. We must raise at least, I believe, £3500. We have received by subscription £187, by donations £268 = £455; our Council has granted £600 = £1055, which must be increased to £3500, and I have no doubt that can easily be done. There is not only the credit of this Society at stake, but the credit of London and of the country requires that the congress should be a success. We are inviting a great number of distinguished foreigners to come to us as our guests, and we must see to their reception, not only as geographers, but as patriotic Englishmen zealous for the credit of our country.

Afternoon Technical Meetings. Tuesday, November 19, 1894.—CLEMENTS R. MARKHAM, ESQ., C.B., F.R.S., President, in the Chair.

The Paper read and discussed was:—

"A Pre-Columbian Discovery of America." By H. Yule Oldham, Esq., M.A.

January 22, 1895.

"Terrestrial Magnetism." By Prof. A. W. Rücker, F.R.S.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. R. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

EUROPE.

Alps—Eastern. *Deutsch. u. Oesterr. Alpenvereins* **25** (1894): 1–94. **Richter.**

Die wissenschaftliche Erforschung der Ostalpen seit der Gründung des Oesterreichischen und des Deutschen Alpenvereins. Von Ed. Richter.

Alps—Glaciers. *Jahrb. Schweizer Alpenclub* **29** (1893–94): 243–254. **Forel.**

Prof. Dr. F.-A. Forel: Les variations périodiques des glaciers des Alpes. Quatorzième Rapport.

Austria-Hungary—Dalmatia. *M.G. Ges. Wien* **37** (1894): 545–557. **Gelcich.**

Die wirthschaftliche Lage Dalmatiens. Bemerkungen von E. Gelcich.

The discussion of the economic condition of Dalmatia concludes with a statement as to the great importance to that region of a complete system of railway connection with the rest of the monarchy.

Central Pyrenees. *Annales G.* **4** (1894): 30–46. **Paringaux.**

Les futures voies ferrées des Pyrénées Centrales. Par M. A Paringaux.

A discussion of the various schemes for penetrating the Pyrenees by railways through valleys and tunnels.

England—Magnetic Dip. **Felgentraeger.**

Die Isoklinen Karte von Whiston und die säkulare Aenderung der magnetischen Inklination im östlichen England. Von Wilhelm Felgentraeger. Aus den Nachrichten der K. Gesellschaft der Wissenschaften zu Göttingen. Mathematisch-physikalische Klasse, 1894. Size 9½ × 6½, pp. 12. *Presented by Prof. Dr. Hermann Wagner.*

France.—Lake Bourget. *C.R.* **119** (1894): 931–933. **Delebecque.**

M. A. Delebecque. Sur l'âge du lac du Bourget et les alluvions anciennes de Chambéry et de la vallée de l'Isère.

Germany—Harz. *M.V. Erdk. Halle a. S.* (1894): 35–44. **Damköhler.**
Die Bevölkerung des Harzgebietes. *With Map.* Von Oberlehrer Eduard Damköhler.

Germany—Harz. *M.V. Erdk. Halle a. S.* (1894): 1–35. **Steinhoff.**
Von den Teufelsmauern bei Blankenburg und bei Thale am Harz. Von Rudolf Steinhoff.

Germany—Spessart. *Notizblatt. V. Erdk. Darmstadt* (1893): 9–18. **Klemm.**
G. Klemm: Gletscherspuren im Spessart und östlichen Odenwald. *With Plates.*

On glacial remains in the neighbourhood of Aschaffenburg.

Iberian Peninsula. *Petermann's M.* **40** (1894): 249–256, 277–285. **Fischer.**
Versuch einer wissenschaftlichen Orographie der Iberischen Halbinsel. Von Prof. Dr. Th. Fischer. *With Map.*

Iceland. **Walker.**
History of the Rev. Oddo V. Gislason, Minister of Staðr i Grindavik (Reykjanes S. W. of Iceland), and missionary in the summer season to his countrymen on the W., N., and E. coasts when engaged in fishing, as well as to fishermen of other nationalities, as a preacher of equal facility in Danish, Icelandic, and English, and his correspondence with Rev. F. A. Walker, D.D., in the years 1890–1894. Also letters from Right Rev. Hallgrimr Sveinuson, Lord Bishop of Iceland, A. Thorsteinson, . . . and Th. Thoroddsen, Geologist of Iceland, etc. MS. *Presented by Rev. F. A. Walker, D.D.*

This manuscript volume contains a great deal of general information regarding Iceland and Icelandic history.

Montenegro. *M.G. Ges. Wien* **37** (1894): 607–623. **Hassert.**
Zur kartographischen Kenntniss von Montenegro. Von Dr. Kurt Hassert.

Norway—Historical. *Norske G.S. Aarbog* **5** (1893–1894): 91–106. **Storm.**
Om opdagelsen af "Nordkap" og veien til "det hvide hav" af prof. dr. Gustav Storm. *With Map.*

Russia—Caucasus. ———
Collection of Materials (Sbornik Materialov) for the description of Regions and Inhabitants of Caucasus. Published by the Administration of the Caucasian Educational District. Vol. xviii. Tiflis, 1894. [In Russian.]

The excellent idea of the Caucasian Education Department, to invite teachers to collect geographical and ethnographical materials in their own localities, most of which are but seldom visited by scientific explorers, and to publish them as a separate periodical, continues to bear excellent fruit. The eighteenth volume of this publication, which was started only a few years ago, is as interesting as the preceding ones. It contains a very valuable collection of Mingrelian songs—some of which have a historical value—with their music, a glossary, and the Russian translation, as well as a good deal of varied linguistic materials for other Caucasian languages. [P.K.]

Russia—Pinsk Marshes. *Globus* **66** (1894): 293–300. **Immanuel.**
Die Trockenlegung des Poljesje. Von F. Immanuel, Wittenberg. *With Map.*

The map shows the present extent of the famous Pinsk marshes, and the areas which have been drained and reclaimed up to 1893.

Russia—South Ural. *Verh. Ges. Erdk. Berlin* **21** (1894): 522–534. **Futterer.**
Herr Dr. K. Futterer: Ein Ausflug nach dem Süd-Ural. *With Map.*

Illustrated by a tectonic and orographic map of the southern end of the Ural system.

Southern Europe. **Fischer.**
Uebersicht über die wissenschaftliche Litteratur zur Länderkunde Südeuropas. Von Prof. Dr. Theobald Fischer in Marburg. [From Geographisches Jahrbuch. XVII. Band, 1894 . . . herausgegeben von Hermann Wagner.] Size 8½ × 5½, pp. [65]. *Presented by the Author.*

Switzerland. ——

Annuaire Statistique de la Suisse. Publié par le Bureau de Statistique du Département Fédéral de l'Intérieur. Quatrième Année, 1894. Bern, 1894. Size 9½ × 6½, pp. xviii. and 444. *Map.*

Switzerland. **Zemmrich.**

Verbreitung und Bewegung der Deutschen in der französischen Schweiz. Von Dr. J. Zemmrich. [Forschungen zur deutschen Lands- und Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. Achter Band, Heft 5.] Stuttgart: J. Engelhorn, 1894. Size 9½ × 6½, pp. 45. *Map.*

This interesting memoir discusses the distribution of the German-speaking people in Western Switzerland, where the prevailing language is French.

ASIA.

Annam. *Tour du Monde* **68** (1894): 401–416. **Lemire.**

Aux Monuments anciens des Kiams (Excursion Archéologique en Annam). Par M. Charles Lemire. *With Illustrations.*

Arabia. *Globus* **67** (1895): 1–6. **Baumann.**

Besuch von Lahadj in Südarabien. Von Dr. Oskar Baumann. *With Illustrations.*

A flying visit to an oasis in the Arabian desert admirably described.

Armenia—Ararat. *Globus* **66** (1894): 309–315. **Seidlitz.**

Pastuchows Besteigung des Ararats. Von N. v. Seidlitz. *With Illustrations.*

Translation of a paper read to the Caucasian section of the Russian Geographical Society in May, 1894. The ascent was made in August, 1893, and the minimum thermometer left on the summit in August, 1888, by Dr. Markoff was found to register −3° F., which, however, is not supposed to be the true minimum temperature.

Asia Minor—Archæology. *Sitzb. A.W. Berlin* (1894): 899–920. **Fabricius.**

Archæologische Untersuchungen im westlichen Kleinasien. Von Prof. E. Fabricius.

The archæological results of the expedition on which Professor Fabricius accompanied Professor Kiepert in 1888. A number of Greek inscriptions are quoted in the text.

Borneo. *Globus* **66** (1894): 336–338. **Zondervan.**

Hallier's Botanische Reisen in West-Borneo. Von H. Zondervan. *With Map.*

Abstract of the Dutch report of Dr. H. Hallier on his botanical journey in 1893–94 in Sumatra.

China. *J.R.I. British Architects* **2** (3rd ser.) (1894): 37–64. **Gratton.**

Notes upon the Architecture of China. By F. M. Gratton. *With Illustrations.*

The illustrations show some fine examples of different classes of Chinese architecture.

India—Bhutan. *Scottish G. Mag.* **10** (1894): 635–640. **Godwin-Austen.**

Bhutan and the Himalayas East of Darjeeling. By Colonel Godwin-Austen.

An abstract of a paper read before Section E of the British Association at Oxford in 1894.

India—Punjab—Lahore. **Walker.**

Gazetteer of the Lahore District. By G. C. Walker, 1893–94. Revised Edition. Compiled and published under the authority of the Punjab Government, Lahore, 1894. Size 10 × 7, pp. xiii., 336, and lxvi. *Presented by the Secretary of State for India.*

India—Sikkim. *Missions Catholiques* **26** (1894): 513, 524, 538, 549, 559. **Gryse.**

A travers le Sikkim. Lettre du R. P. de Gryse. *With Illustrations.*

Indo-China—Tonkin. ——

Publications de l'Union Coloniale Française. No. 8, Octobre 1894. Le Port du Tonkin dans la rade de Tien-Yen. Paris: A. Challamel, 1894. Size 8 × 5½, pp. 18. *Plans. Presented by the Union Coloniale Française.*

Korea. *Globus* **66** (1894): 357–360. **Immanuel.**

Die Broughton-Bai (Ostküste von Korea). Von J. Immanuel. *With Map.*

Malay Archipelago.

Glimpses of the Eastern Archipelago. Ethnographical, geographical, historical. Translated from the Dutch by Geo. G. Batten, Singapore. Printed at the Singapore and Straits Printing Office, 1894. Size 9 × 6½, pp. 138. *Presented by the Translator.*

A series of interesting extracts from Dutch papers well translated, and affording a number of vivid glimpses into the life, habits, and history of the natives of the Dutch East Indies.

Malay Archipelago—Moluccas. *V. Ges. Erdk. Berlin* **21** (1894): 506-521. **Martin.**

Herr Prof. K. Martin: Ueber seine Reise in den Molukken, durch Buru, Seran und benachbarte kleinere Inseln. *With Map.*

Dr. Martin visited the Moluccas in 1891 on a geological excursion, and this paper contains his geographical observations on the land and people.

Perak—Tin Mines. **Wray.**

Perak Museum Notes, No. III. The Tin Mines and the Mining Industries of Perak, and other papers. By L. Wray, jun. Also a paper on the Padi Industry of Krian, by H. W. C. Leech, LL.D., and an Itinerary of a Trip to Gunong Bintang, by G. A. Lefroy, Chief Surveyor, Perak. Taiping, 1894. Size 9½ × 6½, pp. 78. *Map and Plates.*

The main paper in this number of the Perak Museum Notes is the first instalment of a full and authoritative account of the tin mines of Perak, historical, geological, and economic.

Siberia—Fish-skin Tartars. *J. China Br. R. Asiatic S.* **26** (1894): 1-43. **Fraser.**

The Fish-skin Tartars. By E. H. Fraser.

A description of the Orochi of the Amur from Russian sources.

AFRICA.

Algeria—Sahara. *B.S.G. Paris* **15** (1894): 430-466. **Colonieu.**

Voyage au Gourâra et a l'Aouguerout (1860). Par le Commandant Colonieu.

This is the concluding part of a paper the earlier instalments of which were published in the *Bulletin* of the Paris Society in 1892 and 1893.

Algeria—Sahara. *Norske G. S. Aarb.* **5** (1893-1894): 1-23. **Nielsen.**

Atlas og Sahara af prof. dr. Yngvar Nielsen. *With Illustrations.*

British Central Africa. **Johnston.**

Africa. No. 6 (1894). Report by Commissioner Johnston of the first three years' Administration of the Eastern Portion of British Central Africa, dated March 31, 1894. London: Eyre and Spottiswoode, 1894. Size 13½ × 8½, pp. 43. *Maps. Price* 1*s.* 10½*d.*

The geographical results referred to in this report are also contained in Mr. Johnston's forthcoming paper in the *Journal.*

British South Africa. **Knight.**

Rhodesia of To-day. A description of the present condition and the prospects of Matabeleland and Mashonaland. By E. F. Knight. London: Longmans & Co., 1895. Size 8 × 5, pp. vii. and 151. *Map. Price* 2*s.* 6*d.* *Presented by the Publishers.*

Mr. Knight, after travelling through Matabililand and Mashonaland for seven months in 1894, gives a brief but interesting account of the present state of the country, which will command the confidence of the reader. He pronounces the climate remarkably favourable for white men, and praises the administration of the territories, especially noting the good effect of just and kindly treatment on the natives.

British West Africa. **Lucas.**

A Historical Geography of the British Colonies. By C. P. Lucas. Vol. iii.—West Africa. Oxford: the Clarendon Press, 1894. Size 7½ × 5½, pp. 283. *Maps. Price* 7*s.* 6*d.*

East Africa. *Deutsches Kolonialblatt* 5 (1894): 549-553, 575-584. **Lent.**

Ueber Verkehrsmittel in Ostafrika. Von Dr. Lent.

A discussion of the whole question of transport by means of animals in different parts of Africa, taking account of carriage traffic and beasts of burden, with special reference to the camel, ox, horse, ass and mule.

Egypt. **Baedeker.**

Egypt. Handbook for Travellers. Edited by Karl Baedeker. Part I. Lower Egypt and the Peninsula of Sinai. Third Edition. Leipsic, Karl Baedeker; London, Dulau & Co., 1895. Size 6½ × 4½, pp. ccxvi. and 293. *Maps, Plans, etc. Price* 12 *marks. Presented by Messrs. Dulau & Co.*

French Congo—Kwilu. *B.S.G. Paris* (1894): 403–429. **Jacob.**

La vallée du Niari—Kouilou, reconnaissances préliminaires pour l'étude des voies de communication. Par Léon Jacob. *With Map.*

The map of the Kwilu river was the result of surveys by M. Jacob in 1886, 1887, and 1888.

French West Africa—Bondu. **Rançon.**

Le Bondou. Étude de Géographie et l'histoire Soudaniennes de 1681 a nos jours. Par le Dr. A. Rançon. Bordeaux: Imp. G. Gounouilhou, 1894. Size 10 × 6½, pp. 188. *Map. Presented by the Author.*

This memoir has been referred to during its serial publication in the *Bulletin* of the Bordeaux Commercial Geographical Society.

German East Africa. **Lent.**

Deutsches Kolonialblatt. **5** (1894): 599–607, 630–633, 653–659.

Vorschläge zur Verbesserung der Verbindung des Kilimandjarogebiets mit der Küste. Von Dr. Karl Lent. *With Map.*

A full discussion of the importance of improving the means of communication between the temperate slopes of Kilimanjaro and the coast.

German East Africa. *M. Deutsch. Schutzgeb.* **7** (1894): 271–282. **Lieder.**

Beobachtungen auf der Ubena-Nyasa-Expedition. 11 November 1890 bis 30 März, 1894. Von G. Lieder.

Zur Kenntniss der Karawanenwege im südlichen Theile des ostafrikanischen Shutzgebietes. Von G. Lieder. *With Maps.*

German East Africa. *M. Deutsch. Schutzgeb.* **7** (1894): 282–291. **Stuhlmann.**

Bericht über eine Reise im Hinterlande von Bagamoyo, in Ukami und Uluguru. Von Dr. J. Stuhlmann.

St. Helena. *Asiatic Quarterly R.* **9** (1895): 99–116. **Sterndale.**

R. A. Sterndale. St. Helena—the Gibraltar of the S. Atlantic.

Mr. Sterndale gives a careful account of the resources of St. Helena, deploring the neglect to which the island has lately been subject, and pointing out that it is still a strategic position of much importance.

Somaliland—Harrar. **Harris.**

A recent visit to Harrar. By Walter B. Harris. From *Blackwood's Magazine*, September, 1894.

South Africa. **Ricarde-Seaver.**

Diamonds and Gold. Anglo-Saxon supremacy in South Africa, 1814–1894. By Major F. J. Ricarde-Seaver. From the *New Science Review*, July, 1894.

NORTH AMERICA.

Alaska Frontier. *C.R.* **119** (1894): 981–983. **Laussedat.**

M. Laussedat: Reconnaissance faite à l'aide de la Photographie, pour la délimitation de la frontière entre l'Alaska et la Colombie britannique.

Canada. *Scottish G. Mag.* **11** (1895): 1–16. **Tupper.**

Anniversary Address: The Economic Development of Canada. By Sir Charles Tupper, Bart. *With Maps.*

This paper is illustrated by eight maps and two statistical diagrams illustrative of the progress and present position of the Dominion.

Canada. *P. and T.R.S. Canada* **11** (1893): Section 3, 55–60. **Johnson.**

On the need of a "Coast Survey" for the Dominion of Canada. By A. Johnson.

A plea for the establishment of a special marine survey department for the Canadian coasts.

Canada—Canals. *P. and T.R.S. Canada* **11** (1893): Section 3, 25–50. **Keefer.**

The Canals of Canada. By T. C. Keefer. *With Maps and Plans.*

An excellent account of the Canadian canals, with maps and sections showing the present state of inland navigation in the Dominion, with a section on projected canals and statistical tables of the canal-borne traffic from 1870 to 1891.

Canada—Longitudes. *P. and T.R.S. Canada* **11** (1893): Section 3, 51–53. **McLeod.**

Memorandum on the Work of the Montreal Longitude Determination. By C. H. McLeod.

Telegraphic determinations of longitude were made in 1893, from which the following provisional time-intervals from Greenwich have been calculated: Montreal, $4^h\ 54^m\ 18{\cdot}7^s$; Canso, $4^h\ 4^m\ 41{\cdot}3^s$; and Waterville (Ireland), $0^h\ 40^m\ 9{\cdot}3^s$.

Canada—Niagara Falls. *American J. Science* (3) **48** (1894): 455–472. **Spencer.**

The Duration of Niagara Falls. By J. W. Spencer.

A note on this subject will appear in the Monthly Record.

Lake Superior—Sailing Directions. ———

No. 108—Part I. U.S. Hydrographic Office. Sailing directions for Lake Superior, St. Mary's River, and Straits of Mackinac. Washington: Government Printing Office, 1894. Size 9½ × 6, pp. vi. and 115. *Charts and Plates. Presented by the U.S. Hydrographic Office.*

The first issue of a new manual of sailing directions.

Mexico. ———

Anuario del Observatorio Astronomico Nacional de Tacubaya para el Año de 1895 formado bajo la dirección del Ingeniero Angel Anguiano. Año XV. Mexico, 1894. Size 7½ × 5½, pp. 414. *Presented by the Observatory.*

Rocky Mountains. *P. and T.R.S. Canada* **11** (1893): Section 3, 13–15. **Deville.**

Lever topographique des Montagnes Rocheuses, exécuté par la photographie. Par E. Deville. *With Map.*

The map is a beautifully executed piece of hill-work, with contour-lines at intervals of 100 feet combined with shading; the scale is 1 : 40,000.

United States—California. **Ransome.**

The Geology of Angel Island. By F. Leslie Ransome, with a Note on the Radiolarian Chert from Angel Island and from Buriburi Ridge, San Mateo County, California, by George Jennings Hinde, PH.D. University of California, *Bulletin* of the Department of Geology, vol. i., No. 7, pp. 193–240. Berkeley, 1894. Size 10½ × 7.

United States—Census. *J.R. Statistical S.* **57** (1894): 643–677. **Porter.**

The Eleventh United States Census. By Hon. Robert P. Porter (Superintendent of the Eleventh Census).

United States—Mississippi. **Levasseur.**

La Question des Sources du Mississipi. Par M. E. Levasseur. (Extrait du Bulletin de géographie historique et descriptive [Comité des travaux historiques et scientifiques siégeant au Ministère de l'instruction publique]. 1894.) Size 10 × 6½, pp. 15. *Maps. Presented by the Author.*

This will receive separate notice.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Ancient Land-masses. *Annales G.* **4** (1894): 92–100. **Priem.**

L'extension ancienne des Terres australes. Par M. F. Priem.

A statement of the results of recent observations and speculation.

Botanical Maps. *C.R.* **119** (1894): 1236–1239. **Flahault.**

Sur une Carte botanique détaillée de la France. Note de M. Ch. Flahault.

This is noticed elsewhere.

Land-Forms. **Lapparent.**

L'Age des formes topographiques. Par A. de Lapparent. Extrait de la *Revue des questions Scientifiques*, Octobre 1894. Brussels: Imp. Polleunis & Centerick. Size 10 × 6½, pp. 53. *Presented by the Author.*

An effort to emphasize the importance of the mutual relations of geology and geography, with reference to the treatment of land-forms as of various ages in the cycle of development of a land surface by earth-movements and erosion. Professor Lapparent notes with approval the attempts of Professors Penck and Davis to introduce systematic geographical nomenclature.

Magnetism. **Kostinsky.**

No. 109. U.S. Hydrographic Office. Contributions to Terrestrial Magnetism, the Variation of the Compass. From Observations made in the United States Naval Service during the period from 1881–1894. Washington: Government Printing Office, 1894. Size 9½ × 6, pp. 50. *Presented by the U.S. Hydrographic Office.*

Map of the World. **Barbier.**

Le Projet de Carte de la Terre à l'échelle du 1/1,000,000ᵉ devant la Commission technique de la Société de Géographie de l'Est. Rapport présenté par M. J. V. Barbier. Nancy: Berger-Levrault & Co., 1894. Size 9 × 5½, pp. 48. *Presented by the Author.*

This report will be referred to elsewhere.

Meteorology—Clouds. **Ley.**

Cloudland, a Study on the Structure and Characters of Clouds. By Rev. W. Clement Ley. London: E. Stanford, 1894. Size 9½ × 6, pp. xiv. and 208. *Charts, Plates, and Diagrams. Price 7s. 6d. Presented by the Publisher.*

A series of beautiful reproductions of Mr. A. W. Clayden's typical cloud photographs and of the author's water-colour sketches, add much to the value of this important book.

Ocean Currents. *P. and T. Queensland Br. R.G.S. Australasia* **9** (1893–94): 52–58. **Boyd.**

A remarkable Bottle-voyage. By Major A. J. Boyd.

The bottle in question was launched on December 4, 1890, in 11° 26′ S. and 147° 30′ E., and was recovered in October, 1892, in 6° 10′ N. and 171° 30′ E., a minimum drift of nearly 1900 miles having taken place. The time was far too long to allow of any inference as to direction or rate of currents being drawn.

Oceanography. *Natural Science* **6** (1895): 30–37. **Dickson.**

The Distribution of Food-Fishes in relation to their Physical Surroundings. By H. N. Dickson. *With Chart.*

Mr. Dickson discusses the bearings on marine life of his own and other observations of the physics of the oceans.

Oceanography. *Scottish G. Mag.* **10** (1894): 449–462, 525–539, 617–635. **Pettersson.**

A Review of Swedish Hydrographic Research in the Baltic and the North Seas. By Otto Pettersson. Parts IV.–VIII. *With Charts and Sections.*

The concluding instalment of this fine memoir is now published. A separate copy has been presented by the Author.

Oceanography—Wind and Waves. *Sitzb. A.W. Berlin* (1894): 509–525. **Wien.**

Ueber den Einfluss des Windes auf die Gestalt der Meereswellen. Von Dr. Willy Wien.

A mathematical inquiry into the characteristic forms of waves corresponding to different degrees of wind-force.

Physical Geography. **Mill.**

The Realm of Nature: an Outline of Physiography. By Hugh Robert Mill. [Fifth thousand.] London: John Murray, 1894. Size 7½ × 5, pp. xii. and 370. *Maps and Illustrations. Price 5s. Presented by the Author.*

The text has been thoroughly revised since the first issue was reviewed in the *Proceedings*, vol. xix. p. 506.

Physical Geography. **Penck.**

Morphologie der Erdoberfläche von Dr. Albrecht Penck. Bibliothek Geographischer Handbücher, herausgegeben von Prof. Dr. Friedrich Ratzel. Stuttgart: J. Engelhorn, 1894. Size 9 × 6. 2 vols. Vol. i., pp. xiv. and 472; vol. ii., pp. x. and 696. *With Diagrams. Price* 32 *marks. Presented by the Publishers.*

This work is likely to become the standard book of reference for physical geography in the strict sense of the term, and a full notice will shortly be published in the *Journal*.

Physiography.

Elementary Physiography; or, Earth Lore. Adapted to the latest requirements of the Department of Science and Art. Revised Edition. London: G. Gill and Sons, 1894. Size 7½ × 5¼, pp. 318. *Map and Illustrations. Price 2s. 6d. Presented by the Publishers.*

A compilation of extracts from works which are not always the most recent.

Plant-Distribution. *T. South African Philos. S.* **5** (1886–1888): 275-294. **Guthrie.**

On the subjective causes of Evolution as illustrated by the Geographical Distribution of plants. By Professor F. Guthrie.

Plant-Distribution. **Schweinfurth and Ascherson.**

Primitiæ Floræ Marmaricæ, von G. Schweinfurth und P. Ascherson. Mit Beiträgen von P. Saubert. Geneva, Romet, 1893. Size 9½ × 6½. *Plate.*

Plant-Geography. *J. Linnean S.* **30** (1894): 219-263. **Henslow.**

The Origin of Plant-Structures by Self-Adaptation to the Environment, exemplified by Desert or Herophilous Plants. By the Rev. George Henslow.

The author shows how a plant accommodates itself to the peculiarities of its inorganic environment by undergoing structural modifications advantageous to life in its special surroundings. Such changes may be produced in a single generation. Many curious examples are given of plants which rapidly accommodate themselves to new conditions.

Rivers and Estuaries. **Vernon-Harcourt and Partiot.**

Min. P. I. Civil Engineers **118** (1894): 1–189.

The Training of Rivers, illustrated by the Results of various Training-Works. By Leveson Francis Vernon-Harcourt.
Estuaries. By Henri Léon Partiot.

These are important practical papers, rendered more valuable by a voluminous series of comments and criticisms by many authorities; but they have considerable geographical interest as well. M. Partiot adopts a definition of *estuary* which gives the word a meaning somewhat different from that usually employed. He says, "Estuaries are inlets on or near the sea-coast, containing banks which the tides successively cover and lay bare;" and he divides them into two classes—estuaries without rivers, and those into which rivers flow, subdividing each class into estuaries with wide and those with restricted outlets.

River-Entrances. *Rev. G.* **34** (1894): 168–178. **Girard.**

Étude sur les embouchures des fleuves. Par J. Girard.

River Courses. **Günther**

Topographische Studien zur Gestaltung der Flussläufe. Von Prof. Dr. Siegm. Günther. Separatabdruck aus Nachrichten über Geophysik, herausgegeben von J. Berringer und Joh. F. Fehlinger (Band I., 1894). Vienna. Size 9 × 6, pp. 10. *Presented by the Author.*

River Temperature. **Forster.**

Die Temperatur fliessender Gewässer Mitteleuropas. Von Dr. Adolf E. Forster in Wien. Mit einer Tafel und XXV. Tabellen. Vienna, E. Hölzel. 1894. Size 11 × 7½, pp. 96.

This forms Band 5, Heft. 4, of Penck's *Geographische Abhandlungen*, and the subject with which it deals—the temperature of rivers in Europe—will be referred to elsewhere in the *Journal*.

Sea Margins. **Girard.**

La Géographie Littorale, par Jules Girard. Paris, Société d'Editions Scientifiques, 1895 [1894]. Size 10 × 6½, pp. 232. *Price 6 fr. Presented by the Author.*

M. Girard has here combined into a volume the series of articles which we have noticed separately on their original publication in the *Revue de Géographie*. He

treats, but not exhaustively, of the movements of water in the sea, coast erosion, the movement of sand in dunes and banks, the origin of beaches, deltas, estuaries, and the evidence of Earth-movements supplied by littoral phenomena. There are numerous illustrations, the sketch-maps being clear and useful, but the views do not add any value to the book.

Tropical Cultivation. **Des Vœux.**

Delusions about Tropical Cultivation. By Sir G. William Des Vœux. From the *Nineteenth Century*, July, 1894.

GENERAL.

Almanac. **Olsen.**

1895. The Fisherman's Nautical Almanack and Tide Tables. A Directory of all British Fishing Vessels, Steamers, etc. By O. T. Olsen, Grimsby; and London, J. D. Potter [1894]. Size 7 × 5, pp. 420. *Price* 1*s*. *Presented by the Compiler.*

Anthropological Congress. **Wake.**

Memoirs of the International Congress of Anthropology. Edited by C. Staniland Wake, on behalf of the Publication Committee. Chicago, 1894. Size 10 × 6½, pp. 376. *Plates. Presented by Francis Parry, Esq.*

Besides the presidential address by Dr. Brinton, these memoirs consist of thirty-four papers, grouped under Physical Anthropology, Archæology, Ethnology, Folklore, Religions, and Linguistics, and, with the exception of two in German, they are all printed in English.

Antiquarian Research—The Runes. **Stephens.**

The Runes, whence came they? By Prof. Dr. George Stephens. London and Copenhagen: Williams and Norgate, H. H. Lynge, 1894. Size 11½ × 8½, pp. 96. *Illustrations. Presented by the Publishers.*

A catalogue of Runic inscriptions and literature recently discovered, the numerical consideration of which shows that in "Scando-Anglia" 10,423 Runic remains have been discovered, while only 19 have been found elsewhere.

Arabic Languages. **Seidel.**

Praktisches Lehrbuch der Arabischen Umgangssprache syrischen Dialekts. Erläutert durch zahlreiche mit Uebersetzung und Wörterverzeichnis versehene Uebungsstücke. Von A. Seidel. Vienna: A. Hartleben, (not dated) [1894]. Size 7 × 4½, pp. viii. and 193. *Presented by the Publisher.*

Bibliography. **Luzac.**

Bibliographical List of Books on Africa and the East, published in England, between the Ninth Oriental Congress in London in 1892, and the Tenth Oriental Congress at Geneva in 1894. Systematically arranged with Authors' Index. By C. G. Luzac. London, 1894. Luzac & Co. Size 8 × 4, pp. 90. *Price* 1*s*. *Presented by the Publishers.*

A useful list of recent English books of Oriental and African travel and research.

Biography—Johnston. **Johnston.**

Why I became an Explorer. A chat with Mr. H. H. Johnston, C.B. From *Cassell's Saturday Journal*, August 29, 1894. Size 12 × 9½ [1 page].

Biography—Mercator. *Deutsche Rundschau G.* **17** (1894): 132–136. **Wolkenhauer.**

Gerhard Mercator. Ein Gedenkblatt zu seinem 300 jährigen Todestage am 2, December, 1894. Von Dr. W. Wolkenhauer in Bremen. *With Portrait.*

Biography—Oppert. *Deutsche Rundschau G.* **17** (1895): 181–183. **Miessler.**

Ernst Oppert. By Adolf Miessler. *With Portrait.*

Biography—Oswell. **Hughes.**

William Cotton Oswell. By His Honour Judge Hughes. From *Macmillan's Magazine*, August, 1894. Size 9 × 6, pp. 6.

Biography—Prince Henry the Navigator. **Alves.**

Alfredo Alves: Dom Henrique o Infante, Memoria Historica Porto: Typ. do "Commercio do Porto," 1894. Size 11 × 8½, pp. 126. *Presented by the Author.*

Biography—Topley. **Woodward.**

Memoir of William Topley, F.R.S. By H. B. Woodward. (Reprinted from the *Geological Magazine*, Decade iv., vol. i., December, 1894.) Hertford: S. Austin & Sons, 1894. Size 8½ × 5½, pp. 16. *Portrait.*

Besides a biographical notice, this memoir includes a list of Mr. Topley's writings, many of which were geographical.

Biography—Wild. *Deutsche Rundschau G.* **17** (1895): 89–90. **Egli.**

Der Topograph Johannes Wild. Von J. J. Egli. *With Portrait.*

British Empire. **Colomb.**

Wanted, an Imperial Conference. By Sir John Colomb, K.C.M.G. From the *Nineteenth Century*, December, 1894. Size 10 × 6½, pp. 8.

Contains a discussion of the relation between the constituent parts of the British Empire.

British Fleet. **Robinson.**

The British Fleet: the growth, achievements, and duties of the Navy of the Empire. By Commander Charles N. Robinson. London: G. Bell & Sons, 1894. Size 8 × 5½, pp. xviii. and 560. *Illustrations. Price* 10*s.* 6*d.*

Chambers's Encyclopædia.

Chambers's Encyclopædia. A Dictionary of Universal Knowledge. New Edition. 10 vols. London and Edinburgh, W. and R. Chambers, 1888–1895 [1894]. Size 11 × 8. *Maps and Illustrations. Price* £5.

The geographical articles in this Encyclopædia have the advantage of being concise and up to date. All the larger articles are the work of specialists, whose names are given, and they are suitably, if not lavishly, illustrated.

Commercial Geography. *Z. Ges. Erdk. Berlin* **29** (1894): 271–289. **Hettner.**

Die geographische Verbreitung der Transportmittel des Landverkehrs. Von A. Hettner. *With Map.*

This is a very interesting chapter in physical geography dealing with the means of land-transport in all parts of the world, and illustrated by a map, on which are shown in colours the regions where trade is carried on by (1) railways; (2) waggons drawn by horses, mules, or oxen; (3) sledges drawn by oxen, reindeer, or dogs; (4) beasts of burden, horse, mule, ass, cattle, llama, sheep or goats, elephant, camel, reindeer; (5) human porters; and (6) by water.

Early Civilization. **Maspero.**

The Dawn of Civilization: Egypt and Chaldæa. By G. Maspero. Edited by A. H. Sayce. Translated by M. L. McClure. London: S.P.C.K., 1894. Size 11 × 7½, pp. xii. and 800. *Map and Illustrations. Price* 24*s.* *Presented by the Publishers.*

This is a work of exceptional importance. The immense number of illustrations, nearly 500, is of itself no small contribution to the popular study of ancient civilizations; and the fact that the use of the blocks has been specially lent by the French Government printers is a pleasing instance of modern international courtesy. The first chapter describes, under the title of "the Nile and Egypt," the ancient geography of the country, and refers to the cosmogony of the early Egyptians. Succeeding chapters deal with the gods of Egypt, the legendary history, and political constitution of early Egypt, the Memphite empire, and the first Theban empire. The last three chapters are devoted to Chaldæa, dealing in a similar way with the monuments of that phase of early civilization. We note, amongst some other anomalies of orthography, the use of the word "peninsular" for "peninsula."

Educational—Commercial Geography. **Gonner.**

Commercial Geography. By E. C. K. Gonner. London: Macmillan and Co., 1894. Size 7 × 5, pp. xi. and 206. *Price* 3*s.*

This book is divided into three parts: I. Commercial Geography and its principles; II. The Geography of the chief products and others; III. Countries, their Agriculture, Industries, and Commerce. The definition of Geography as "the study of the environments of Man" is a very wide one, being rather general than precise.

Educational—Commercial Geography. **Mill.**

Pitt Press Series. Elementary Commercial Geography. By Hugh Robert Mill. Second Edition. Cambridge: The University Press, 1894. Size 7 × 5, pp. 196. *Price* 1*s.* 6*d.* *Presented by the Author.*

Revised and greatly enlarged, with the addition of a full index.

Educational. **Frye.**

Primary Geography. By Alex. Everett Frye. London: E. Arnold [not dated]. Size 10½ × 8½, pp. vii. and 127. *Maps and Illustrations.*

This beautifully illustrated quarto is a fair specimen of the fine work habitual in the school geographies in use in America; but the exclusively American standpoint which fits it so well for the purpose it was designed for may be found an obstacle in European schools. One column is devoted to the British Isles, and this includes two illustrations relating to other countries, while thirty-four columns are devoted to the United States, and less than half a column to Canada. The design of the book is as good as its execution.

Gazetteer. **Frey.**

Chambers's Concise Gazetteer of the World. Topographical, Statistical, Historical. London and Edinburgh: W. & R. Chambers, 1895 [1894]. Size 8 × 6, pp. 768. *Price* 5*s.* *Presented by the Publishers.*

This is by far the best general gazetteer of small size at present available. The articles, necessarily short, are carefully compiled, and contain a large amount of accurate information in a readily accessible form. It should not, however, be anonymous.

Geographical Year-book. **Wagner.**

Geographisches Jahrbuch, begründet 1866 durch E. Behm. XVII Band, 1894. . . . Herausgegeben von Hermann Wagner. Gotha: Justus Perthes, 1894. Size 9 × 6, pp. xii. and 464, maps, 28.

This year the subjects dealt with in detail in this invaluable summary are the following: Cartographical progress, with special reference to projections and the history of cartography, by Professor E. Hammer; Progress in our knowledge of terrestrial magnetism (1891–92), by Professor Karl Schering; Report on the progress of geographical meteorology (1891–93), by Professor Brückner; Report on ethnological researches (1891–93), by Dr. Georg Gerland; General maps of the official cartography of the chief countries, by Dr. Hermann Wagner; and Geographical literature relating to Europe, Introductory by Dr. Hermann Wagner, Southern Europe by Dr. Theobold Fischer, France by Dr. P. Camena d'Almeida, Switzerland by Dr. J. Früh, German Empire by Dr. Ludwig Neumann, Great Britain and Ireland by Dr. H. G. Schlichter, Netherlands and Belgium by Dr. H. Blink, Scandinavia by Dr. E. Löffle, European Russia by Dr. Anuchin, and Austria Hungary by Dr. Robert Sieger.

Methods of Sepulture. **Preuss.**

Die Begräbnisarten der Amerikaner und Nordostasiaten. Inaugural-Dissertation von Theodor Preuss. Königsberg, Braun und Weber, 1894. Size 8½ × 5½, pp. xviii. and 314. *Presented by the Author.*

An elaborate discussion of the methods of disposing of the dead employed amongst the primitive peoples of North-Eastern Asia and North America.

North Atlantic Directory. **Findlay.**

A Directory for the North Atlantic Ocean, comprising instructions, general and particular, for its navigation. By Alexander George Findlay. Fifteenth Edition. Revised and Edited by W. R. Kettle. London, R. H. Laurie, 1895 [1894]. Size 10½ × 6½, pp. xii. and 1006. *Charts.* *Presented by the Editor.*

The usefulness of this well-known book has been prolonged by careful revision, and the addition of a certain amount of new matter. The account of the various islands in the Atlantic contains much information of general interest, although the book as a whole is intended for the service of the practical navigator.

Travel. **Dewar.**

A Ramble round the Globe, by Thomas R. Dewar. London, Chatto and Windus, 1894. Size 8 × 5½, pp. xv. and 316. *Illustrations.* *Price* 7*s.* 6*d.* *Presented by the Publishers.* *Another copy presented by the Author.*

A humorous record of a holiday round the world.

NEW MAPS.

By J. Coles, *Map Curator*, R.G.S.

EUROPE.

Austro-Hungary. **Artaria.**

Artaria's Eisenbahn und. Post-Communications-Karte von Oesterreich-Ungarn, 1895. Scale 1 : 1,700,000 or 26·7 stat. miles to an inch. Verlag von Artaria & Co., in Wien. *Price 1 fl. Presented by the Publishers.*

England and Wales. **Ordnance Survey.**

Publications issued since December 8, 1894.

1-inch :—

ENGLAND AND WALES:—178, 179, 180, 181, 195, 210, 211, 212, 293, 294, 309, engraved in outline; 320, hills engraved in black and brown; 128, 172, hills photozincographed in brown, 1*s.* each.
SCOTLAND:—128, hills, 1*s.* 9*d.*

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ENGLAND AND WALES:—**Lancashire,** 42, 2*s.*; 59 S.E., 63 S.W., 64 N.W., 68 N.E., S.E., 69 N.W., 70 S.W., 71 N.E., S.E., 76 N.W., S.W., 79 S.E., 80 N.E., S.W., S.E., 81 S.W., 83 N.W., 84 N.W., 85 N.E., S.E., 86 N.E., S.W., S.E., 87 S.W., S.E., 88 N.W., N.E., S.E., 91 N.W., 95 N.W., S.W., 101 N.W., 102 S.W., 103 N.W., 107 S.E., 111 N.W., S.E., 113 N.E., 1*s.* each. **Yorkshire,** 3, 169, 2*s.* 6*d.* each; 187, S.W., 201 N.W., N.E., 204 N.W., 215 S.W., 216 S.W., S.E., 217 N.E., 218 N.W., N.E., 229 N.W., N.E., 230 N.E., S.E., 231 N.W., S.E., 233 N.W., 244 N.W., 259 N.W., S.W., 271 N.W., 297 S.W., 1*s.* each.

25-inch—Parish Maps :—

ENGLAND AND WALES:—**Lancashire,** CV. 7, 10, 14*s.* each (coloured).

Town Plans—5-feet scale :—

London (Revision), LX. 10, 20, 30, 40, with houses stippled, 2*s.* 6*d.* each.

——— 10-feet scale :—

London—Re-survey (Hornsey Parish), III. 51-2, with houses stippled, 2*s.* 6*d.*

(*E. Stanford, Agent.*)

France. **Delebecque.**

Atlas des Lacs Français. Par A. Delebecque, Ingénieur des Ponts et Chaussées, Department de la Haute-Savoie. Part II. Ouvrage couronné par la Société de Géographie de Paris. *Presented by the Author.*

This is the second part of an important atlas of the French Lakes, the previous issue of which was noticed in the *Geographical Journal*, April, 1893. It contains maps of the following lakes:—Plate 8: Lac de la Motte, Lac du Grand Maclu, Lac de Chalain, Lac de Narlay, Lac Dessous, Lac Dessus, in the Department of Jura. Plate 9: Lac de Laffrey, Lac de Petit-Chat, Department of Isère, and Lac de la Girotte in the Department of Savoy. Plate 10: Lac d'Issarlés, Department of Ardèche: Lac du Bouchet, Department of Haute Loire; Lac Pavin, Lac de la Godivelle d'en Haut, Lac de Tazanat, Lac Chauvet in the Department of Puy-de-Dôme. In addition to these, a corrected map, Lac d'Aiguebelette, in the Department of Savoy, is given.

On each sheet the latitude, longitude, level, and area of each lake are given. The depths are shown in different shades of blue, and by contour-lines for every change of five metres, the places where soundings were taken being indicated by dots. This atlas forms a valuable addition to our knowledge of the hydrography of Europe.

ASIA.

Indo-China. **Pavie.**

Carte de L'Indo-Chine, Dressée sous les auspices des Ministres des affaires étrangéres et des colonies par M.M. les Capitaines Cupet, Friquegnon et de Malglaive Membres de la mission Pavie. Scale 1 : 2,000,000 or 31 stat. miles to an inch. A. Challamel, Paris, 1895.

This is a revised and reduced edition of Pavie's map of Indo-China. It has been produced in the same style as the larger edition, and is a very good specimen of cartography.

AFRICA.

East Africa. **The Nyasa Company.**

Map of the district of Cabo Delgado, showing the route of the Nyasa Railway and the locations of the principal mineral discoveries, from the surveys of Mr. J. T. Last, leader of the Royal Geographical Society's Expedition, 1885, 1886, 1887. Scale 1 : 1,450,000 or 22·8 stat. miles to an inch. The Nyasa Company. *Presented by Col. J. Harris.*

North-East Africa. **Chaurand.**

Carta dimostrativa della Etiop'a—Compilata dal Capitano di Stato Maggiore Enrico de Chaurand. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. Comando del Corpo di Stato Maggiore, 1894. 6 sheets. *Price complete, 13 lire. Presented by the Bureau de comptabilité du Corps d'Etat-major italien.*

When complete this map will consist of eight sheets. The six at present supplied comprise the country between lat. 7° N., and 19° N. and from long. 34° 40′ E. to 47° 10′ E. All boundaries and routes are laid down, and a large amount of detail is shown. The map is printed in three colours, water being shown in blue, routes in red, and lettering in black. There is no hill shading, but the principal elevations are indicated by crosses, and some of the heights are given in figures. This map, when completed, will be accompanied by an index.

AMERICA.

Alaska. **Lindenkohl.**

Der Küstendistrikt von Süd-Ost Alaska. Nach den Originalkarten der U.S. Coast Survey und der Geodetic-Survey-Commission, gezeichnet von A. Lindenkohl, Washington D.C. 1893. Scale 1 : 1,200,000 or 18·9 stat. miles to an inch. Petermann's 'Geographische Mitteilungen,' Jahrgang, 1894, Tafel 19. Gotha: Justus Perthes, 1894. *Presented by the Publisher.*

Guatemala. **Sapper.**

Die Republik Guatemala nach eigenen Aufnahmen gezeichnet von D. C. Sapper. Karte I. Reiserouten and Oro-Hydrographie. Karte II. Geologische Übersicht. Karte III. Verbreitung der Vegetations Formationen. Scale 1 : 900,000 or 14·2 stat. miles to an inch. Petermann's 'Geographische Mitteilungen,' Ergänzungsheft No. 113, Tafels 1, 2, 3. Das Flussgebiet des Rio Polochic, entworfen von D. C. Sapper, Juni, 1892. Scale 1 : 600,000 or 9·5 stat. miles to an inch. Petermann's 'Geographische Mitteilungen,' Ergänzungsheft No. 113, Tafel 4. Gotha: Justus Perthes, 1894. *Presented by the Publisher.*

GENERAL.

Educational. **Hickmann.**

Prof. A. L. Hickmann's geografisch-statistischer Taschen-Atlas. 16-20 Tausend. Wien: Verlag der kartografischen Anstalt G. Freytag and Berndt. *Price 3 marks. Presented by the Publishers.*

The special feature in this little atlas is the extensive use that is made of diagrams to illustrate comparative statistics. It contains physical, political, and ethnographical maps, and statistics in tabular form.

The World. **Kiepert.**

Kiepert's grosser Hand-Atlas. Neue Lieferungs-Ausgabe in 45 Karten. Ausgabe in 9 Lieferungen à 5 Karten mit statistischem Material und Namen-Verzeichnis mit Bevölkerungsziffern zu jeder Karte. Die statistischen Angaben von Dr. Paul Lippert, Bibliothekar des Kgl. Preuss. Statist. Bureaus. Part 7. Berlin: Geographische Verlagshandlung Dietrich Reimer. Inhaber: Hoefer and Vohsen. *Price of each part, 4 marks. Presented by the Publishers.*

Sheet No. 2 is a map of the Eastern Hemisphere; No. 5 is a general map of Germany, with an inset on an enlarged scale of Berlin and its environs; No. 37, a general map of Africa, with inset on an enlarged scale of the Cape Colony; No. 44 is a map of Central South America, with insets of Central Ecuador and Rio Janeiro and environs; No. 45, Chile and the Argentine Republic, with plans of Buenos Ayres and Monte Video, and an inset map of the central part of Chile. Each map is accompanied by explanatory letterpress, and an index which gives the population of all important places.

Historical Geography. **Schrader**

Atlas de Géographie Historique, ouvrage contenant 54 grandes cartes doubles en couleurs, accompagnées d'un Texte historique au dos et d'un grand nombre de cartes de détail, figures, diagrammes, etc. Par une Réunion de Professeurs et de savants sous la direction géographique de F. Schrader. 10e Livraison. Paris: Librairie Hachette et Cie, 1894. *Presented by the Publishers.*

Part No. 10 of this Atlas contains the following maps: Syria after the death of Solomon, about the year 927 B.C.; the Eastern World about the middle of the ninth century, B.C.; Asia Minor in the ninth century, B.C.; the Roman Empire at the close of the fourth century; the progress of Christianity since the year 400; Palestine in the time of Jesus Christ; a simplified reduction of the "Catalan map;" and a map embracing the same area beneath it for reference. The maps are all very nicely drawn, and are accompanied by excellent explanatory notes, which are illustrated by maps.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts cancelled in September and October, 1894.

No.	Cancelled by	No.
2613 France, north coast, Sheet XI. 2612 France, north coast, Sheet XII. 2611 France, north coast, Sheet XIII.	New Plan. Cape Levi to Fécamp	2613
	New Chart. Fécamp to Boulogne	2612
507 Unare and Puerto Santo bays. 509 Pampatar and Moreno bays, and port of Laguna Grande del Obispo. 510 Port of Mochima. 511 Corsarios and Estanques bays. 394 Plan of Orchilla harbour, Cumana anchorage, San Juan Griego bay, Esmeralda bay, Carupano bay, Porto Santo bay, and Coche island anchorage on this sheet. 512 Port el Roque. 395 Plans of Bahia Honda, Tucacas San Juan bay, Port Turiamo, Puerto Chichirevichi, and Port el Roque on this sheet.	New Chart. Ports and anchorages on the north coast of South America	1523
680 Ngonci road and Venambi bay. 662 Hastie road and Port Choiseul. 685 Tangtang harbour.	New Chart. Plans on the east coasts of Madagascar	680
733 Hanfela bay.	New Chart. Hanfela bay	733
2722 Plans of Pulo Panjang, and Pulo Wai on this sheet.	New Chart. Plans in Gulf of Siam	2101
1570 Malo island to Efate island	New Chart. Malo Island to Efate Island . . .	1570

Charts that have received Important Corrections.

No. 2040, England, south coast:—The Solent, Hurst point to Cowes and Southampton Water. 2330, Norway:—Sheet IV., Svenöer to Koster islands,

including Christiania fiord. 2322, Netherlands:—Scheveningen to Ameland, including the Zuider Zee. 2302, Gulf of Bothnia:—Sheet 7, Tome point round the head of the Gulf to Tauvõ. 2296, Gulf of Bothnia:—South Quarken to Hornslandet. 2215, Gulf of Finland:—Kronstadt, north and south channels. 2115, Denmark:—The Sound. 790, Denmark:—Approaches to Copenhagen, with Drogden and Flint channels. 2664, France, west coast:—Sheet 2, D'Arcachon point to De la Coubre point, including river Gironde to Bordeaux. 2292, Black Sea:—Akmechet harbour. 1853, South America, west coast:—Callao harbour. 1390, Africa, east coast:—Chale point to Pangani, including the island of Pemba. 6B, Gulf of Aden:—Sheet 2, western portion. 2766, New Guinea:—North-east coast of New Guinea, with Bougainville, New Britain, New Ireland, Admiralty islands, and off-lying reefs. 1579, New Hebrides:—Malekula Island, southern part.

J. D. Potter, agent.

Pilot Charts. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for December, 1894, with supplement giving the weather conditions on the North Atlantic Ocean for Six Days.—Pilot Charts of the North Pacific Ocean for December, 1894, and January, 1895. Published at the Hydrographic Office, Bureau of Navigation, Department of the Navy, Washington, D.C., Charles D. Sigsbee, Commander, U.S.N. Hydrographer.

PHOTOGRAPHS.

France, Switzerland, Tonkin, etc. **Jackson and Others.**

171 Photographs of France, Switzerland, Tonkin, and Anam. *Presented by Mr. James Jackson.*

This is a series of 171 photographs, 150 of which have been taken by Mr. James Jackson in France and Switzerland, and 21 presented by the same gentleman, are views of Tonkin and Anam. Mr. Jackson has been one of the largest contributors to the Society's collection, and these photographs, like others he previously presented, are excellent specimens of photography.

Iceland. **Grossmann and Cahnheim.**

150 Photographs of Iceland, taken by Dr. Karl Grossmann and Otto Cahnheim in 1892. *Presented by Dr. Karl Grossmann.*

This series of photographs was taken by Dr. Karl Grossmann and Mr. Otto Cahnheim during their visit to Iceland in 1892. They are well chosen to illustrate the geological features and scenery of the country, as well as incidents of travel in Iceland.

Malay Peninsula. **Becher and Others.**

121 Photographs of the Malay Peninsula, taken by the late Mr. H. M. Becher, and others. *Presented by Gen. S. Becher.*

This is an excellent series of photographs of the people, scenery, mining works, etc., of the Malay Peninsula, most of them having been taken by the late Mr. H. M. Becher, who was unfortunately drowned in 1893 while attempting to reach a mountain in the interior of the Malay Peninsula called Gunong Tahan.

Norway. **Mockler-Ferryman.**

17 Photographs of Norway (Hardangar, etc.), taken by Captain A. F. Mockler-Ferryman in 1894. *Presented by Captain A. F. Mockler-Ferryman.*

This is a series of views taken by Captain A. F. Mockler-Ferryman in Norway during the past year in the Hardangar district. They are well chosen to illustrate the scenery and physical features of the country.

Palestine. **Robinson Lees.**

10 Photographs of Palestine, taken by G. Robinson Lees, Esq. *Presented by G. Robinson Lees, Esq.*

This is a very interesting series of photographs presented by Mr. G. Robinson Lees to the Society.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.